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FACULTY OF EDUCATION
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Editor's Message

Readers will note that there are some changes in the list of consulting editors with this issue.

After serving for a period of four years, the following scholars have retired from their duties as consulting editors of AJER:

James Britton
John Calam
K. DeClerck
Rupert N. Evans
Grant Harman
S. Hunka
D.A. MacIver

They have been replaced by the following, whose institutional affiliation and research interests are included.

David C. Bjorkquist, Professor and Head, Division of Industrial Education, *University of Minnesota*, Minneapolis; the preparation of teachers for vocational and industrial education, computer applications in teacher education.

Peter E. Bryant, Professor of Psychology, Department of Experimental Psychology, University of Oxford; developmental psychology with Piagetian background, cognitive processing in students.

André Côté, Professor and Chairman, Department of Psychopedagogy, Faculty of Education, University of Ottawa; cognitive psychology and Piagetian theory as it applies to education.

Donald Fitzgerald, Professor and Head, Centre for Behavioural Studies in Education, The University of New England, Armidale; the development of psychometric models of individual differences in cognitive processing, laboratory and school-based studies of the interaction between patterns of instruction, and the provision of educational services in areas of special need using computer and communication technology.

Keith Watson, Professor, University of Reading School of Education; comparative and international education including third world matters, multicultural education, educational administration, and community education.

The wide ranging research interests of these new members make it possible for them to provide essential advice in the process of manuscript assessment. At the same time they serve as a panel to consider general matters which relate to the production of the journal.

To those who are retiring, I wish to express my sincere appreciation for the time and energy they have given to A.J.E.R. over the past three years. The former editor, Dr. Henry W. Hodysh, and I are indeed indebted to them.

I wish to welcome the new group of Consulting Editors and extend the wish that their term of appointment will be challenging and satisfying.

Doyal Nelson

MILTON E. MARCH

Narrabundah College, Australia

and

ERWIN MIKLOS

The University of Alberta

Dynamics of Control over Educational Decisions

In a questionnaire survey superintendents of schools in British Columbia, Alberta, Saskatchewan and Manitoba reported their perceptions of the degree of control exercised by each of five decision levels — department of education, school board, superintendent's office, principal, and teachers — over 32 decision items. Three perceptions were sought: degree of control at the time of data collection in 1980, a recollection of the situation in 1975, and a projection of the control likely to be exercised in 1985. Results of the analysis confirmed that, in the views of superintendents, changes in the locus of control over various items had occurred from 1975 to 1980 and further changes were projected for the period from 1980 to 1985. In general, the changes reflect a gradual yet continuing growth of influence on the part of teachers and principals but no dramatic change in the pattern of control over educational decisions. An examination of factors which influence the locus of control indicated that the centralizing forces were expected to strengthen and the decentralizing forces to diminish in the period from 1980 to 1985. This represents a reversal from the situation which prevailed in the period from 1975 to 1980. If the perceptions of the respondents are accurate, then the growth in influence over educational decisions at the school level may be reaching a plateau in the systems included in the survey.

Dr. March (PhD, University of Alberta) is Principal of Narrabundah College, Kingston, A.C.T. He has been involved in designing the structures and procedures for assessment of senior students in the Territory, and from 1974, chaired the Curriculum Working Party which helped formulate the style of the present curricula for the A.C.T. School Authority. In recognition of his services to education, Dr. March was awarded the Queen's Silver Jubilee Medal in 1977 and, in 1981, he was made a Member of the Order of the British Empire.

Dr. Miklos (PhD, University of Alberta) has served as teacher and principal in schools and has been with the Department of Educational Administration at the University of Alberta since 1962. His main teaching and research interests are in the general area of administrative processes in educational organizations. Dr. Miklos has recently been awarded a McCalla Research Professorship for 1982-83.

Changing circumstances are contributing to a heightened awareness of the substance of educational decisions and of the process through which those decisions are made. The issues which command the attention of decision makers at all administrative levels are both familiar and numerous: meeting the needs of an increasingly diverse clientele, ensuring the quality of educational programs, responding to public criticism, allocating resources effectively, and using facilities efficiently, to name but a few. Not only is there no shortage of proposed solutions to persistent problems but there seem to be ever more actors who wish to become involved in decision making or to exercise some influence over the process. Indeed, a central question of philosophical, political and practical significance is "Who should control the decision processes in education?" While that is the fundamental question, this paper is focused on a more modest topic, specifically, on the control actually being exercised at provincial, district and school levels over selected educational decisions. Although a description of where control resides will not tell us where it ought to reside, still the information may prove helpful to those who desire to understand educational decision making either as a base for action or for further research.

Perspective

Control Over Decisions

Control over decision making in education appears to be dynamic, not static. The shifting, fluid nature of control is reflected in the observation of several commentators. Not only is there agreement among them that changes in locus of control over specific decisions have taken place and are taking place, but, even more, differences in emphasis between analyses would seem to confirm the fact of changes over time. A few years ago Peter Coleman (1977) observed that there had been a wider diffusion of power through provincial systems of education in Canada. Among factors contributing to this shift was the rising professionalism, together with increasingly militant attitudes, of teachers generally. In his view the groups which had experienced net losses of power included provincial governments, trustees and administrators while net gains were enjoyed by teachers, teachers' associations, special interest groups, parents, and, to a lesser extent, students. Looking ahead, Coleman (1977) suggested that in the long run participation and responsiveness would decline, while in the short run decision making would likely take place in an atmosphere of conflict rather than of cooperation.

Other commentators would seem to agree with the observation that there has been a period of power diffusion in education. According to Farquhar (1980), the decentralization period covered about a decade beginning in the mid-1960s and was reflected in moves such as the elimination of province-wide examinations and replacement of provincially-appointed inspectors with locally employed superintendents. He suggested that the trend has been reversed and that now there are indications of a move toward re-centralization. This analysis finds support in the views of Williams and Powell (1980) who identify a number of indicators of a shift in control over crucial decisions from school districts to the provincial level. Among these are limits on budgets, control over teacher negotiations, more prescriptive curriculum guides, and increased involvement in the evaluation of students.

As further indication that "control is shifting slowly to the centre," Williams and Powell (1980, p. 48) point to the tendency of organized groups representing

the public, teachers, or trustees to concentrate their activities at the provincial level. One possible explanation for this shift is the apparent readiness of provincial departments of education to become involved when local agencies seem to be immobilized.

Emphasizing only the centralizing aspects probably would not describe adequately all shifts in the locus of control over educational decisions; decentralization and centralization may occur simultaneously (Miklos, 1974). The introduction of school-based budgeting gives professional personnel at the school level increased control over certain decisions, while the community school concept and parent advisory committees provide the public with new opportunities for "grass-roots" involvement in educational decision making. These shifts may not always take place in a climate of cooperation and harmony. As Williams and Powell (1980) note, public involvement in the form of organized interest groups may threaten the autonomy of educators; such groups may reduce the control exercised by professional administrators when they gain access to school boards.

The activities of organized interest groups may further exacerbate a condition which Farquhar (1980, p. 6) described as "a lack of visible, forceful professional leadership in Canadian education." Although chief executive officers may be regarded as leaders, their impact is, by the nature of the position, restricted to the local level and may be reduced even further if decision making becomes more politicized. A situation in which "No individual or group can claim to be 'in charge'" (Farquhar, 1980, p. 6) is a situation in which control over decision making is problematic.

Related Research

Most of the research on control over educational decisions has been focused on involvement in decision making at school and school district levels. Particular attention has been given to preferences for various decision modes, to discrepancies between actual and preferred degrees of involvement by different groups, and to variations in perceptions about decision making of persons in different educational positions.

In a study which is typical of those conducted in this general area, Simpkins (1968) investigated the actual and desired levels of participation of Alberta teachers in four decision areas: curriculum planning and adaptation, classroom management, arrangement of instructional program, and general school organization. Results indicated that teachers exercised most control over classroom management decisions and desired higher levels of involvement in the other three areas. The desire for increased participation was confirmed in a study conducted by Clarke (1970); however, his results suggested that the key element in the expectations of teachers was increased involvement rather than total control over any area of decision making. Similarly, results of a study by Knoop and O'Reilly (1977) suggested that teachers desire a decreased emphasis on principals as sole decision makers and a preference for increased use of group procedures in school level decision making.

Whether or not the desired changes actually have occurred may be influenced, in part, by differences in perceptions and beliefs between those who control the decision process and those who seek involvement. A number of studies have reported discrepancies between teachers' and principals' views. For example, Corriveau (1969) found that a sample of Quebec teachers preferred more

participation than principals thought they should have. Although results obtained by Louden (1980) in an Alberta study indicated that most decision making was participative and that principals perceived teachers to be satisfied with the level of teacher involvement, many teachers expressed a preference for increased involvement.

In one of the few studies which has examined decision levels other than the school, McBeath (1969) obtained perceptions of teachers in Saskatchewan on decision making about such aspects of educational programs as curriculum, goals and objectives, instruction, and evaluation. Five decision making levels were considered: classroom, school, school system, provincial, and national. Teachers perceived that most of the decisions about programs were made at the provincial level and that the least number were made at the school level. Whether this has changed somewhat in recent years as a result of pressures from teachers for increased involvement remains an open question.

Although studies such as those which have been reviewed have provided useful information about control over educational decisions, some gaps in the research are apparent. One of these relates to analyzing control over specific decisions at various levels of the educational system; another concerns possible changes in locus of control in response to various professional, administrative and environmental factors.

Research Problem

A number of research questions are suggested by current issues and previous studies: Who controls the decisions which have an impact on the operations of schools? What changes have taken place in control over these decisions? What changes are likely to take place in the future? What factors will have an impact on changes in the locus of control? These questions were the main focus of a recent study (March 1981a) on control over educational decisions. This paper is based on some of the results presented in that report.

Design of the Study

The basic approach taken in the study was a questionnaire survey of individuals who served as school district superintendents or directors of education in British Columbia, Alberta, Saskatchewan, and Manitoba. School superintendents and directors of education were selected as the respondent group on the assumption that officers at that level were best situated to have an overview of the decision process. Furthermore, it was also assumed that they were likely to have observed the changes which had taken place in recent years and, from their knowledge of forces at work, to be best able to predict changes which might occur in the near future. The four western provinces were chosen partly because of convenience and partly because of apparent similarities in their educational systems.

A list of decision items was initially developed from questionnaires used in studies such as those reported by Simpkins (1968), McBeath (1969), Corriveau (1969) and Knoop and O'Reilly (1977). Additional items were generated by the researcher in order to reflect recent developments in education; through a process of consolidation, 117 items were obtained from an initial list of about 200. The items were categorized under eight headings: finance and budgeting; capital expenditures; equipment, supplies and services; curriculum and instruction;

personnel management; pupil management; organizational structure; and community relations. Specific items related to such decision situations as allocating funds to a school from a school district, selecting a principal for a school, and determining the procedures for assessing student progress.

Four persons — two superintendents, one assistant superintendent, and one regional officer — were asked to rank order the items in terms of their relevance to decision making in the educational systems in the provinces included in the study. Five items from each of the eight categories were selected, and a group of respondents was asked to complete the questionnaire and to comment on the suitability of the items. Results of this pilot study suggested that a questionnaire of 40 items was longer than desirable.

As a result of the selection process and the pilot studies, the items finally selected satisfied the following criteria: (1) they reflected actual decisions on which some degree of control was exercised at various levels, and (2) they were representative of the eight areas of decision making. Limiting the length of the questionnaire to 32 items was deemed advisable in order to keep the demand on respondents within reasonable limits.

The questionnaire containing these items invited respondents to indicate their perceptions of the degree of control over each decision which was exercised by each of five levels: department of education, school board, superintendent's office, principal, and teacher(s). Three responses were required: impressions of the situation at the time of data collection in the spring of 1980; recollections of the situation as it existed in 1975; and predictions for the situation in 1985. A five-point response scale ranging from negligible degree of control (1) to a high degree of control (5) was used.

Respondents were also asked for their perceptions of the effect which each of eleven factors had on the locus of control over educational decisions. These eleven factors were as follows: general economic climate; social climate; political climate; pressure from teachers' associations; school board policy; department of education policy; pressure from trustees' associations; teachers' drive for professional status; current practices in administration; calls for public accountability; and superintendents' personal philosophy. Response alternatives ranged over a five-point scale from "strong centralizing influence" through neutral to "strong decentralizing influence."

Questionnaires were distributed to all superintendents or directors of education in the four western provinces as listed in the 1980 *CEA Handbook*. Preliminary letters requesting cooperation and follow-up letters to nonrespondents were used in an attempt to improve the response rate. In total 278 persons were contacted, and replies were received from 178. Six responses did not contain sufficient information; as a result, 172 or about 62 percent of those originally contacted were included in the data analysis.

The major approach to data analysis was the comparison of mean scores for individual items for the various subgroups of respondents: the total group, provincial subgroups, jurisdiction type subgroups, and year (1975, 1980, or 1985). Since the target group was the entire population of superintendents in the four western provinces, reliance on statistical tests of significance was not strictly appropriate; furthermore, heed was taken of the caution expressed by Cormier (1971) of the need to distinguish between "significant" and "important" differences. Nevertheless, tests of significance were used as guides when choosing

a value which might be considered as substantial for the difference between any pair of measures.

Results

When the superintendents' perceptions of the degree of control over the 32 educational decisions were analyzed, the main control for the large majority of items was found to be distributed among the school board, the superintendent's office, and the school principal levels. Teachers held the highest degree of control for only one item, that which was associated with awarding final marks or grades in high school subjects. The department of education held the highest degree of control for only two items: selecting textbooks for a particular subject and determining the broad outline of the curriculum.

Neither the superintendent's office nor the principal was perceived to have the lowest degree of control over any item; however, this was the case for the school board with respect to three items which related to curriculum, textbooks, and final grades. The board's main areas of control appeared to be in matters involving funding. The principal had most control over internal school matters, especially those associated with students. Many of the matters over which the superintendent's office had the highest degree of control were of an administrative nature. A full discussion of these and related results has been reported by March (1981b) in *The Canadian Administrator*.

The analysis on which this report is based focused on responses to 32 individual decision items by the total group of respondents for two time periods: 1975 to 1980 and 1980 to 1985. Three research questions were addressed:

1. What changes in control over educational decisions have occurred, or are projected to occur, at each decision level?
2. In what decision areas do these changes affect the pattern of control across the five levels?
3. What factors have influenced past or projected changes in control over educational decisions?

Results of the analysis for each question are presented in the sections which follow.

Changes in Degree of Control

Changes in the locus of decision making are subtle, complex, and difficult to document; however, some indication of general shifts may be obtained by simply comparing the number of decision items over which control at a particular level increased with the number of items over which control decreased during a particular period of time. A comparison of such changes for each of five organizational levels is presented in Table 1.

The data, based on superintendents' perceptions, indicate that from 1975 to 1980 the department of education experienced fewer total changes than did the other levels; for the changes that did occur, the number of items over which control decreased (6) was greater than the number over which control increased (3). Only the school board level experienced a similar decrease but this was offset

by an increase in control over nearly twice as many decision items (11). Superintendents increased their control over one-half of the 32 items included in the list while principals and teachers enjoyed increases on nearly all of the items.

TABLE 1
NUMBER OF ITEMS INVOLVED IN CHANGES IN CONTROL
AT FIVE DECISION LEVELS

Level	1975-1980		1980-1985	
	Decrease	Increase	Decrease	Increase
Education Department	6	3	4	7
School Board	6	11	5	7
Superintendent	1	16	3	6
Principal	0	30	0	25
Teachers	0	31	0	29

Note: The maximum number of changes, decreases and increases combined, at each level in each time period is 32.

Further increases in control were projected for teachers and principals in the period from 1980 to 1985. All other levels were expected to increase their control over more items than the number for which control would be decreased; however, relatively few items are involved in these changes at any particular level.

The general pattern of change which emerges is one of increasing control over a broad range of decision items at the level of the school and classroom for the ten-year period. At the level of the school district — school board and superintendent — the net change is in the direction of increased control with some decreases in specific areas. At the level of the department of education, there would seem to be little change in areas of control; only a few items are involved, and increases appear to be balanced by decreases.

An examination of individual items was carried out to determine the decision areas in which changes in the locus of control had taken place or were projected to take place. Since principals and teachers were perceived by respondents as increasing their control over a broad range of decision items without experiencing any decreases, only the other three levels of decision making — department of education, school board, and superintendent's office — are of particular interest.

Some patterns were evident in the changes in control exercised by the department of education over the ten-year period. A decrease in control over the design of school buildings which began in the first period was projected to continue into the second; however, community use of buildings was expected to come under increased control. Decreased control by the department over selecting textbooks was perceived and projected for the full ten-year interval. A decrease in control was perceived as well in determining the number of teachers needed by a school.

There are a number of interesting reversals during the second as compared to the first five-year period. For example, a decrease in control over setting minimum and maximum class sizes from 1975 to 1980 was likely to be offset by increased control over these decisions in the second period. Similarly, decreased control over final grades in high school subjects was likely to be reversed in 1980-85. Indeed, an increase in control over a number of decision items was projected by respondents in the assessment area including procedures for assessing student progress, deciding reporting procedures, publicizing test results, and determining procedures for evaluating instruction. Increased control was anticipated also over education programs of a special or innovative nature.

The major areas in which decreased control by school boards was perceived or projected related to the management of physical facilities and finance at the school level; specific decisions involved allocating funds to schools, distributing those funds within schools, and selecting equipment and furnishings. Some decrease in control was also indicated in the personnel area, particularly in relation to selecting teachers and principals. School boards were perceived to be increasing their control over decisions relating to the evaluation function (both students and instruction), selecting textbooks, developing special educational programs, establishing school-community relations, determining school size, and several other operational matters.

Superintendents were perceived to have decreased their control over only one decision item during 1975 to 1980, namely, deciding on how funds allocated to a school are to be used. This decrease in control was projected to continue along with decreased control over selecting teachers and school furnishings. The decisions over which increased control by the superintendent's office was perceived or anticipated were distributed across all areas. Three of the specific items were associated with community relations while seven others involved various operational matters ranging from building construction to deciding on the staff complement for schools. Six items were of a general educational nature such as selecting textbooks, determining school programs and evaluating instruction. The projections for 1980-85 indicated that the degree of control would continue to increase over two community relations items and three operational items but that there would be no further increases in control over the educational items. Student conduct was the only other area expected to come under increased control from the office of the superintendent during this period.

Changes in Pattern of Control

The changes just described would seem to suggest that there has been a gradual transfer of control over many decision items to the school level. Testing this tentative conclusion requires an examination not only of the changes but also of the degree of control held by the various levels before and after the change. A comparison of the patterns of control — the rank order of the five levels in terms of degree of control exerted — before and after the changes revealed that these were affected for only 14 of the 32 decision items. Patterns of control for each of these items are presented in Table 2 for 1975, 1980 and 1985.

The first eight items in Table 2 are those which involved some increase in control over decisions by teachers. As is evident, the first four items are those over which they had the least control and had shifted, or were expected to shift, to second in rank order ahead of the department of education. On the next item

— parent advisory groups — teachers were projected to move from second to third rank order in degree of control. Only on two decision items — textbooks and in-school financing decisions — have teachers increased their control from second to fourth in rank order. They were projected to move from second lowest to second highest in one other area, namely, classroom furnishing decisions. These last two areas also involved some reduction in the degree of control exercised by superintendents and school boards.

TABLE 2
CHANGES IN PATTERNS OF CONTROL OVER DECISION ITEMS

Decision Item	1975	1980	1985
Funds to school	T D P S B	D T _ _ _ _	_ _ _ _ _
Special areas	T D P S B	D T _ _ _ _	_ _ _ _ _
Number of teachers	T D P S B	D T _ _ _ _	_ _ _ _ _
Finance special program	T D P S B	_ _ _ _ _	D T _ _ _ _
Parent groups	D T S B P	_ _ _ _ _	_ S T _ _ _
Textbooks	B T P S D	_ S _ T _	_ _ _ _ _
Finance in school	D T B S P	_ B S T _	_ _ _ _ _
Classroom Furnishings	D T S B P	_ _ B S _	_ B S T _
Major equipment	D T P S B	_ _ _ _ _	_ _ S B P
School program	T B D P S	_ D B _ _	_ _ _ S P
Field trips	D T P S B	_ _ _ _ _	_ _ S P _
Selecting principals	D P T S B	_ _ _ B S	_ _ _ _ _
Student transport	T P S D B	_ _ D S _	_ _ _ _ _
Lesson schedule	D B S T P	_ _ _ _ _	B D _ _ _

Note: Rank order is from lowest to highest degree of control exercised by the organizational levels: D = department of education; B = school board; S = superintendent's office; P = principal; T = teacher(s). A _ indicates no change from first column.

Changes in patterns of control for three decision items involved principals. In the opinion of the respondents, control by principals is likely to shift to highest in rank order in relation to equipment and school program decisions, and to second highest (following the school board) in decisions about field trips. These same decision items involved a reduction in the degree of control exercised by the superintendent.

The degree of control which superintendents have over selecting principals has increased in comparison with the board, while control over student transportation has increased over that previously exercised by the department of education. In

the opinion of the respondents, the department of education will exert somewhat more influence over one specific operational matter (lesson scheduling) while the degree of control exercised by the board was projected to decrease.

An analysis of these patterns of decision control indicates that although increases in control for teachers and principals were evident on a broad range of decision items, few of these increases resulted in changes in the pattern of rank orders of control exercised by the five levels. A possible explanation for this result is that the increased control by teachers and principals results from greater participation by these groups in decision making and from a more influential type of involvement which does not reduce the degree of control exercised by the other levels except in the few instances indicated.

Factors Influencing Changes

Respondents were asked to report their perceptions of the degree to which each of eleven factors influenced the locus of control over decisions. The eleven influences suggested by various sources in the literature included both environmental factors, such as the economic and political climates, and operational factors, such as school board policy and administrative practices. In Figure 1 the relative centralizing/decentralizing influence of the eleven factors is displayed graphically.

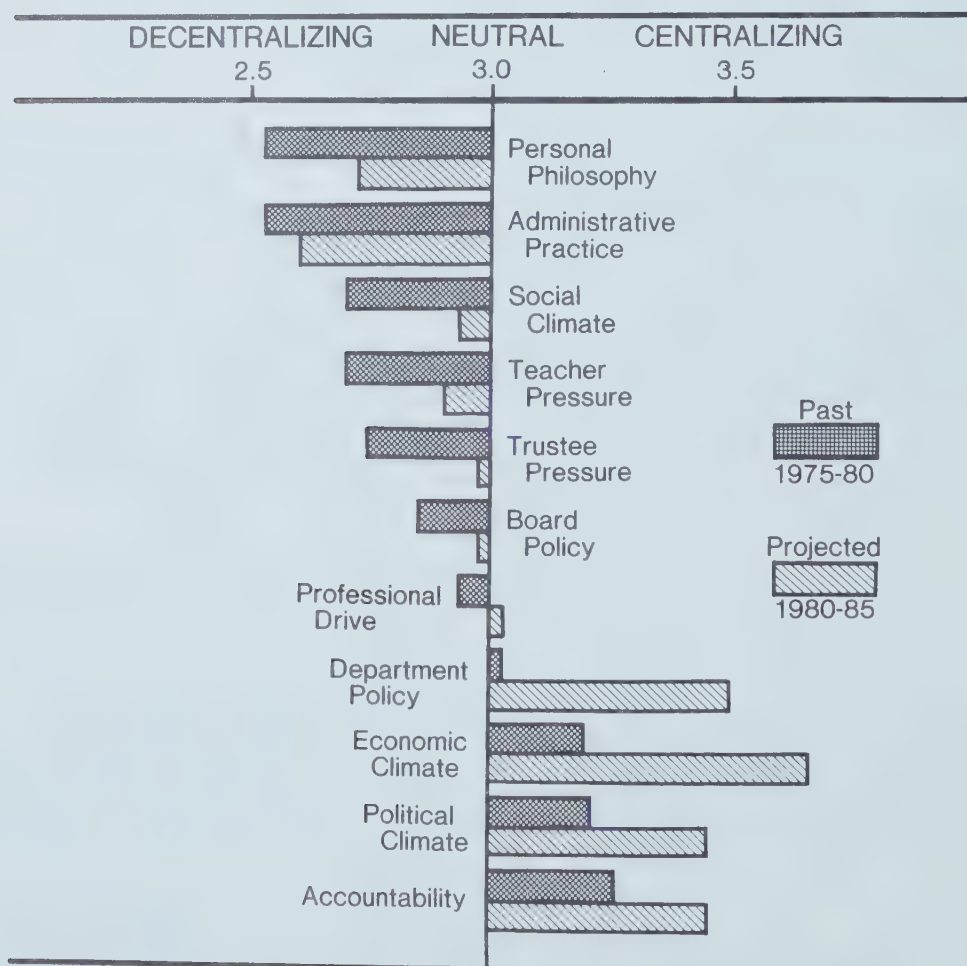


Figure 1. Relative strength of centralizing/decentralizing influences.

As is indicated by the bar graphs, the factors tend to fall into three broad clusters: those which consistently have a decentralizing influence, those which consistently have a centralizing influence, and those which have relatively little influence on the locus of control over decisions. Four factors were perceived as having a definite decentralizing influence from 1975 to 1980: the superintendent's personal philosophy, administrative practices, the social climate, and teacher pressure. A centralizing influence was perceived to be exerted by three factors during the same period: the economic climate, the political climate, and calls for accountability. Little influence on the locus of control was attributed by superintendents to trustee pressure, board policy, drives for professional status, and policies of the department of education.

The same general influence was projected by the respondents to continue through 1985; however, some changes in the strengths of these factors are anticipated. In particular, the major decentralizing forces are expected to diminish while all centralizing forces are expected to increase in intensity. Changes in policies of the department of education and the changing economic climate appear to be particularly noteworthy. The sum total of these influences suggests that there has been a reversal from a situation which was favorable to decentralization to one which is more favorable to the centralization of decision making.

These results support a model which portrays the locus of decision making as being determined by the interplay of forces for centralization and forces for decentralization which coexist at any one time. Among the factors considered in this analysis, the major forces for decentralization would seem to be internal to school jurisdictions and of an ideological nature such as prevailing beliefs about the appropriate locus of control over various decisions. Forces which tend to favor centralization of decision making are external to the educational system such as the economic and political climates. A major factor which moderates the influences of these forces is department of education policy. When the external centralizing forces are in ascendance, as they seem to be at the present time, even the internal decentralizing forces seem to be modified to some extent; however, to the extent that local authorities have control over the locus of internal decisions, administrative practice can continue to favor decentralization, for a time at least, in spite of pressures for increased centralization at the upper levels of structure.

Conclusion

Results of the analysis confirmed that, in the opinions of the respondents, changes occurred in the degree of control exercised by different levels between 1975 and 1980, and that further changes were anticipated by 1985. Perhaps the most noteworthy feature of these changes is an apparent increase in the total amount of control being exercised over educational decisions — more levels are perceived to be exerting increased control over more decision items. Within this general context there seems to be a decentralizing trend in the sense that most decreases have occurred at the department and school board levels while most of the increases in control over decision items have occurred at the level of the superintendent's office, the principal and teachers. Although the department of education and school boards may have reduced control over some decision areas, there were indications of an increase in what might be termed "quality control" decisions, in particular, decisions relating to the assessment of students and educational programs.

Although there appear to be many changes in the degree of control exercised by various levels, these changes were of a relatively minor nature and usually did not alter the pattern of control over decisions in any significant way. Consequently, the general trend was not one of a major decentralizing shift of authority towards the school but rather of a gradual yet continuing growth of influence by both teachers and principals. Some of the increases in control by teachers have come in areas where they have traditionally had limited control, and this increase seems to be at the expense of the department of education. The changes are probably insignificant for the department but highly important for teachers. Also significant are indications that teachers have gained somewhat more control over decisions relating to the classroom and that principals, together with teachers, have gained more control over decisions affecting the school. In general, the examination of patterns of control supports the interpretation that the changes reflect the development of more participatory decision models, and delegation of responsibility accompanied by monitoring activities at higher levels rather than any dramatic change in the pattern of control.

An examination of the factors which are likely to influence changes in control over decisions suggests the probable simultaneous operation of both centralizing and decentralizing forces. The perceived greater effect of such decentralizing forces as the personal philosophy of administrators and administrative practice, particularly during the first five-year period, seems to be consistent with perceived increases in control exercised at the school level. There are clear indications of a more centralizing influence for the period 1980-85 when compared with 1975-80. Factors which were perceived to exert a decentralizing influence in the earlier period were predicted to decline in the projected five-year period while factors which have a centralizing influence — in particular, economic and political climates as well as department policy — were expected to increase in strength. If these perceptions of superintendents are accurate, the growth in influence of teachers and principals may be reaching a plateau.

In general, the results of the study provide support for some of the observations discussed in the earlier part of this paper. There is some support for Coleman's (1977) conclusion that teachers have enjoyed a net gain in control over decisions while the department of education and school boards have experienced net losses. Although a period of decentralization may not be followed by a dramatic reversal, the general trend described by Farquhar (1980) also is supported. If the centralizing forces do increase in intensity, they may clash with the aspirations of educators and with the trend toward increased control over decisions by lower levels of the organizational hierarchy. This observation serves to underline the predictions of Williams and Powell (1980) and of Coleman (1977) for increased conflict in the control over educational decision making. The challenge which this presents for all involved is to approach the conflict in a manner which places the political motives secondary to ensuring that the quality of decisions is not compromised.

In conclusion, some observations about the implications of the results for practicing educators and for researchers would seem to be in order. Those who would seek to influence control over decisions may find it helpful to note that there can be significant changes in control without disturbing the overall pattern of control; that is, changes in degree of control need not be threatening and disruptive. Furthermore, the direction of the changes is, at least to some extent, in the hands of educators themselves in the sense that some influential forces are

internal to the educational system. Whether or not these forces are actually operative would seem to be more a matter of will than of fate. For the researcher, there is every indication that changes will continue; in brief, that there will be something to study. The area promises to be one of continuing interest for both the practising administrator and the scholar.

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References

- Clarke, G. A. Teachers' perceptions of school decision making roles. Unpublished Master's thesis, Edmonton: The University of Alberta, 1970.
- Coleman, P. Power diffusion in educational governance: Redefining the roles of trustees and administrators in Canadian education. In J. H. A. Wallin (Ed.), *The politics of Canadian education*, (C.S.S.E. Yearbook, Vol. 4). Edmonton: Canadian Society for the Study of Education, 1977).
- Cormier, R. A. Of significant and important differences. *Alberta Journal of Educational Research*, 1971, 17(1), 33-42.
- Corriveau, R. L. A comparison of principals' and teachers' perceptions of the actual and preferred degree of teacher participation in a number of decisions. Unpublished Master's thesis, Edmonton: The University of Alberta, 1969.
- Farquhar, R. H. Unique factors affecting Canadian education. In R. Farquhar & I. Housego (Eds.), *Canadian and comparative educational administration*. Vancouver: Centre for Continuing Education, University of British Columbia, 1980.
- Knoop, R., & O'Reilly, R. R. Decision making procedures and teacher participation. *The Canadian Administrator*, 1977, 17(3).
- Louden, L. W. *Administrative decision making in schools*. Unpublished doctoral thesis, Edmonton: The University of Alberta, 1980.
- March, M. E. *Variations in degree of control over educational decisions*. Unpublished doctoral thesis, Edmonton: The University of Alberta, 1981. (a)
- March, M. E. Control over educational decisions. *The Canadian Administrator*, 1981, 21(3). (b)
- McBeath, A. G. *A survey of the perceptions of the levels of decision-making in educational programs in the elementary and secondary schools of Saskatchewan*. Unpublished doctoral thesis, Urbana: University of Illinois, 1969.
- Miklos, E. Forces affecting the decentralization of decisions. In E. W. Ratsoy & D. M. Richards (Eds.), *Decentralized decision making in school districts*. Edmonton: Department of Educational Administration, The University of Alberta, 1974.
- Simpkins, W. S. *The distribution of decision making authority in the school*. Unpublished doctoral thesis, Edmonton: the University of Alberta, 1968.

Williams, T. & Powell, M. J. Issues in Canadian educational administration. In R. Farquhar & I. Housego (Eds.), *Canadian and comparative educational administration*. Vancouver: Centre for Continuing Education, University of British Columbia, 1980.

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Teacher Perspectives on the Teaching of Writing

From the ways in which 80 items dealing with the teaching of written composition were freely sorted by 93 teachers of year ten English from large, state high schools in Southeast Queensland, a seven-fold typology was obtained after applying a category-focusing version of Latent Partition Analysis, an Index of Similarity Analysis, an Hierarchical Grouping Analysis, and a Multiple Discriminant Analysis. The statistically derived viewpoints were then clinically inspected by comparing, group by group, the categorizations made by the 15 representative teachers with the 20 nuclear categories that were shared by the original sample of teachers. Fewer pedagogically than statistically significant differences were found. Since the seven perspectives seemed to converge and reflect a traditional rather than a progressive pedagogy, teacher education courses may have to follow the learner-centred strategies they advocate.

Modern mass societies are made up of a bewildering array of social worlds, and individuals live successively in many of them. The English teacher, for example, may also be a sailing enthusiast, an orchardist, or political party worker and thus lead a segmented kind of existence. However, even the cultural area of the teacher's professional life, the teaching of English, is also liable to cleavage. Divisions may form around differences in sex, age and experience, qualifications, and teaching paradigms. But no matter what viewpoints are adopted, teachers' occupational perspectives or personal construct systems represent those categories of thought in terms of which they attempt to grasp the nature of teaching. Smith and Geoffrey (1968, p. 96) argue that teaching must be seen as an intellectual, cognitive activity and that what goes on in the heads of teachers must be a critical antecedent of what they do.

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Educational controversies are particularly able to divide the teaching profession by promoting alternative paradigms or definitions of pedagogy. For example, while one colleague may champion the direct teaching of the skills and complain about an alleged decline in composition, another in the same staffroom may advocate simply letting pupils read, write, and talk as much as possible with a minimum of adult interference. A third teacher of writing becomes acutely aware of the existence of these different outlooks when caught up in situations where conflicting demands are made. The staffroom thus functions as an arena of legitimation or negotiation where contrasting views of teaching are fought for and opposed.

Separate sections of even such a small epistemic community as teachers of year ten English may conceive of the reality of teaching writing in terms of very different symbolic coordinates. Each segment may divide the reality conceptually in a different way. Kelly's theory of personal constructs suggests that people (or groups) differ in how they perceive and interpret a situation, in what they consider important about it, and in what they consider its implications; that is, "persons differ from each other in their construction of events" (Kelly, 1955, p. 55). Groups of teachers who share distinctive subsystems may construe together as "birds of a feather" and co-produce their own reality.

Review of Literature

A number of studies of teachers' different viewpoints have been made. For example, Combs and Soper (1963, p. 226) have found that it is possible to distinguish effective, helping professionals on the basis of their richer perceptual organizations, while Runkel and Damrin (1961) report that student teachers who become the most effective teachers are those who make the most pronounced movement first from complex to simple, and finally from simple to complex viewing of children. They begin their teaching by using a large number of surface, irrelevant dimensions, then recognize a smaller number of important characteristics but end up employing more criteria that are situationally relevant.

Kerlinger (1958, 1967) has shown that two relatively orthogonal factors, "traditionalism" and "progressivism," seem to underlie teachers' attitudes towards education. Sontag (1968) used an 80-item Q-sort instead of a questionnaire in order to measure 80 American elementary and high school teachers' perceptions of desirable teacher behaviours. The items are concise statements that reflect teachers' classroom behaviours in the areas previously used by Kerlinger. The high school teachers' sort yields four factors: general subject matter, concern for students, structure and subject matter, and norms and rules. Most of the teachers rated as traditionalists load on the first factor and the progressives on the second.

Barnes and Shemilt (1974) have used sentence completion tasks to look at the ways 125 British secondary teachers differ in their tacit assumptions about the teaching of writing. The questions were deliberately vague so that in attributing meaning to them the respondents were compelled to use their own covert assumptions about writing. While it proved very difficult to categorize the replies, a significant factor called "Transmission-Interpretation" was found.

According to Barnes and Shemilt (1974, pp. 220-227), the Interpretation teacher sees writing as a means by which pupils can reshape their world-views. The teacher tries to ensure that students see the writing as relevant to their own purposes and as contributing to a dialogue in which they play a crucial part.

Therefore, the pupils' writing is given the status of wider publication, and is allowed to influence the direction of lessons. On the other hand, the Transmission teacher is primarily aware of writing as a means of measuring the pupils' performance against the teacher's own expectations and criteria. When setting written work, the teacher focuses upon the kind of writing that is wanted, assuming it is the teacher's business to define their task and then to provide students with feedback, indicating their success in measuring up to the teacher's standards. The writing is to be addressed to a general, disembodied reader rather than to the teacher or the students themselves. Finally, it is believed that it is the teacher's main responsibility to indicate errors and award grades.

Barker-Lunn (1970) and Ashton, Kneen, Davies and Holly (1975) have also found traditional and progressive groups among British primary school teachers. In their study of the effects of teaching style on British primary school pupils' progress, Bennett, Jordan, Long and Wade (1976) have identified three major teacher types as formal, mixed, and informal. Re-analysis of the data by Aitkin, Bennett and Hesketh (1981) confirms the existence of three distinguishable teaching styles. Three large scale American classroom investigations (Brophy & Evertson, 1974; Soar, 1973; and Stallings & Kaskowitz, 1974) have been made of two opposed pedagogies which they label direct instruction and flexible inquiry. Gray and Satterly (1981) have concluded that the formal-informal, traditional-progressive debate continues to represent one of the more popular ways of speculating on the effectiveness of teachers, regardless of the research difficulties.

Miller (1981) has found that, using educational statements as a basis, a typology of educational orientation and of educational theories could be constructed between the extremes of teacher and child-centredness. In the present study, the constructs that teachers have of teaching written composition are studied in order to determine whether or not they cluster into well differentiated viewpoints and to discuss their pedagogical as well as their statistical significance.

Procedure

A number of different techniques are available to measure teachers' ideas or constructs: sentence completion, in-depth interviewing, word association, Kelly's Repertory test, the Q-sort, the semantic differential, and a free object sort. Kelly's (1955, p. 145) electronic analogue of his information-processing model of thinking suggests that a sorting task is appropriate since it takes account of the process whereby, when people scan surrounding events, they "light up" certain of their categories or constructs. These systems represent kinds of scanning patterns which they continually project upon their world. As they sweep back and forth across a particular field, they pick up blips of meaning. The more adequate their scanning patterns, the more meaningful their world becomes.

A free-sort was seen as providing an observation method of enough structure to allow for quantification of the responses but without unduly influencing the form of the classifications. It was selected instead of a Repertory test for three reasons. First, the events to be construed were taken from the domain of the teaching of writing and consisted of teaching behaviours rather than relations with particular people. Second, a free-sort permits the teachers to generate only those relationships or constructs which they normally use themselves. Finally, 93 teachers rather than just a few individuals were being investigated.

The first step in the present study involved the generation of statements about the teaching of writing which the teachers could scan. These items were derived, not directly from interviewing teachers, but from a search of the most recent and relevant literature as contained in 33 widely used text and reference books, periodicals, and taxonomies of teaching. The procedure is regarded as valid since personal and provided elements have been shown to produce functionally equivalent measures for normal persons and supplied elements seem useful in studies involving group comparisons (see Diamond, 1980). Miller et al. (1967, p. 118) report that while it is extremely time consuming to interview even 30 teachers in order to generate items for sorting, comparable results are obtained by making a systematic selection of stimuli from the relevant literature. In the present study, the teachers themselves commented on the representative nature of the 80 statements. They claimed to have heard many of them previously from teacher educators, administrators, and other classroom teachers. The events seemed to relate directly to their teaching lives.

Rosenshine (1976, p. 338) has argued that two foci characterize all models of teaching behaviour. The first kind can be labelled behaviour-analytic, detail specific and structured. The learner proceeds through small, prescribed steps towards each goal. The other model can be described as inquiry-oriented and learner-centred. The learner has greater choice of the means to be employed toward reaching the goal. Rosenshine (1976, p. 340) asserts that these two are the dominant approaches to education: structured and direct instruction versus flexible inquiry. Accordingly, the skills-based and the growth-oriented pedagogies were used to guide the sampling of statements in an a priori fashion. For example, Items 26 and 63 correspond to a more traditional viewpoint:

Learning to write is a conscious, mechanical skill learned in a progressive sequence of techniques for combining words into sentences, sentences into paragraphs and paragraphs into an essay. The teacher dispenses these rules, precepts and principles and the pupils learn by drill. (26)

The teacher must control the topic to be written about and the way in which it may be written about; she alone must be the audience for whom her pupils write; she must set the length and time limits. All the pupil has to do is perform and then revise the indicated errors. (63)

In contrast, Items 5, 35 and 47 exemplify a more progressive construct system:

As they mature, young people naturally learn to write. (5)

Our pupils are essentially positive, creative beings and in their writing they can attain to creative insights valuable to themselves and others. (35)

The chief concern of the English program is to enable the children to use their developing resources of language to explore their personal experiences. (47)

One hundred of these statements were pretested on a heterogeneous group of nine experienced and practising teachers of year ten English. From this pilot, 80 items emerged as being unambiguous and not too general. This sample size accorded with Kelly's recommendation of 20 to 30 rows or triads. In further support, Miller et al. (1967) found that, after allowing for training, no more than 120 statements could be sorted in two hours.

The 80 items were printed on cards (10 cm x 8 cm) and presented to a volunteer sample of the teachers of year ten English from 22 large, state high schools in Brisbane and Ipswich (Southeast Queensland). The sorting session was held with groups of no more than eight teachers at any one time. In all, 93 sorters were used and each of them was identified by means of a four-digit code number. Miller et al. (1976) have advised that stable base line data are obtained if a heterogeneous sample of at least 30 sorters is available.

After a training task involving the sorting of complex hexagons had been completed, each teacher was presented with the deck of 80 different cards. Each card was numbered with the corresponding number on the reverse side. The number was assigned strictly in an alphabetic fashion so that as few clues as possible were given for the classification. It was a free-sort in that the subjects were able to group the statements on whatever basis they thought appropriate, apart from agreement or disagreement. The instructions were as follows:

To form your groups please carry out the following directions ONE STEP AT A TIME:

1. READ and STUDY the first statement or card.
2. DECIDE what aspect of teaching writing this statement concerns.
3. WRITE a tentative outline of this idea on the first envelope, which you then number as ONE. This gives the group a name, so that for each group you will have a REASON for thinking its component statements go together, irrespective of whether you agree or disagree with them.
4. PUT the statement inside the NAMED envelope.
5. REPEAT steps 1-4 for each statement. If any NEW ITEM concerns the SAME aspect of teaching writing as one that you have previously sorted, PUT THE TWO together in the same envelope. IF not, begin a new group by writing a new, tentative title on another envelope and placing the statement inside it. NUMBER each envelope.
6. RESORTING. At anytime during the sorting task, you may come across a statement that does not seem to belong where you had previously placed it; you may do one of three things with it: EITHER (a) Place it in another group envelope where you think it now belongs, OR (b) Start a new group with it and name its envelope, OR (c) Mix it with the other statements not yet sorted.
7. REVIEW your groupings carefully when you have finished assigning all the 80 statements into categories. Review the ideas in each category with special concern for whether the statements seem to you to BELONG TOGETHER. You may make any changes you like by dividing, combining or switching the cards or statements. Even contradictory statements can be placed in the same group, providing that they deal with the same idea or topic.
8. CHECK finally to see that you have written a short phrase on EACH envelope used that you think best describes the central unifying IDEA that caused you to place the statements together. EACH envelope should be NUMBERED so that you can tell how many groups have formed and each of them can be identified. Remember, however, that as far as this project is concerned, there are NO right or wrong answers.

9. Remember that your groups can consist of DIFFERENT NUMBERS of statements; a group can consist of MANY OR FEW items.
10. Fifteen minutes before the end of the session you will be able to review your groupings.

PLEASE START. DO NOT HURRY AS YOU HAVE 80 MINUTES.

When another sample consisting of 11 teachers in their fourth year of professional preparation, together with two very experienced, well qualified, and promoted teachers of English, sorted the 80 items on two separate occasions, one month apart, the mean measure of self-agreement that resulted was .71, with a range of .56 to .85. Accordingly, the data-gathering procedure is regarded as sufficiently reliable.

Statistical Analysis and Results

When the teachers sorted the items, their individual subsets or groups were regarded as manifest categories or constructs. The statistical operation known as Latent Partition Analysis was applied in order to summarize the data and to make apparent the major similarities in all the teachers' categorizations. This technique identified empirically the set of categories that were presumed to be latent in the population of teachers being studied.

The program constructed a joint proportions matrix. This was an 80 x 80 matrix, A, where

$$a_{ij} = \frac{\text{number of subjects who placed items } i \text{ and } j \text{ together}}{\text{total number of subjects.}}$$

If a_{ij} was low (approximately zero), then very few teachers placed the two items in the same category. However, if a_{ij} was high (approximately unity) then most teachers grouped items i and j together. The matrix thus provided a measure of the relationship between each pair of items.

A principal factor analysis was next applied in order to discover the unrotated factors that existed in the previous proportions matrix together with the latent roots of the factors. Following suggestions made by Wiley (1967) and Evans (1970), those principal components with latent roots greater than unity were iterated to provide a principal factor solution. The principal factor coefficients formed the input for the final program to compute category probabilities and coefficients. In this way, the 20 nuclear categories or major ideas used by the teachers were identified. This set is presented in Table 1. It has been discussed by Diamond (1979) as representing teachers' conventional understandings and their implicit theory of teaching writing.

Since none of the categories has a probability of greater than .58 of being formed, it is clear that not all of the teachers used every construct to structure their thinking about the teaching of writing; that is, there is potential disagreement within the English teaching profession over very fundamental concepts at least at this level.

In order to identify in the greatest detail the distinctive viewpoints used to conceive of the teaching of writing, the categories formed by the 93 teachers were compared teacher by teacher to produce a similarity matrix. The measure, s , was

proposed by Evans (1979, pp. 389-391) as an index of similarity of categorization. It is defined as:

$$s = 1 - \frac{d}{d_{\max}}$$

Consider two categorizations of the same n stimuli, C_1 and C_2 . The set C_1 has c_1 categories and C_2 has c_2 categories. Let f_{kj} be the number of elements of category j of C_1 also occurring in category k of C_2 . Let F be the matrix of elements f_{kj} . As an example, if there are eight stimuli, and C_1 is the partitioning, 12/34/56/78, while C_2 is the partitioning, 1246/3578, then $c_1 = 4$, $c_2 = 2$, $n = 8$, and F would be the 2×4 matrix in Table 2 below.

TABLE 1
TEACHING WRITING: TWENTY CATEGORIES

No.	Title	Category Probability
I	Teacher-Student Relationship	.37
II	The Mechanical Skills	.51
III	Motivation	.27
IV	Feedback	.50
V	Difficulties in Writing	.37
VI	Developmental Writing Sequence	.29
VII	The Importance of Talk	.58
VIII	The Growth Model	.44
IX	The Deductive Teaching of Writing	.36
X	Writing Topics	.32
XI	Natural Development	.48
XII	Sense of Audience	.38
XIII	The Ideal Teacher of Writing	.43
XIV	Correctness versus Appropriateness	.48
XV	The Inductive Teaching of Writing	.25
XVI	The Best Writing	.36
XVII	Students' Positive and Creative Nature	.44
XVIII	Teacher Domination	.36
XIX	The Futility of Abstractions	.21
XX	Criticisms of Conventional Teaching of Writing	.45

TABLE 2
EXAMPLE OF F MATRIX

		C_1				
		1	2	3	4	d components
C_2	1	$\begin{bmatrix} 2 & 1 & 1 & 0 \\ 0 & 1 & 1 & 2 \end{bmatrix}$				2
	2					2
d components		0	1	1	0	d = 6



Figure 1. Plot of Within group variance against Number of groups.

The F matrix is bordered by the individual components of d. These are merely the sums of all but the largest element of each row or column. In the above example, d = 6.

The value of d_{\max} is given by:

$$d_{\max} = n \left(\frac{2 - c_1 + c_2}{c_1 c_2} \right)$$

For the present example this has the value of 10, and s is .40. The similarity index, s, ranges from 0 representing no agreement to 1 representing complete agreement and is related to the “categoric similarity index” used by Triandis (1959) and the “index of colinearity” developed by Runkel (1956). In the present study, s was found to range from .16 to .60.

Though the similarity matrix for the 93 teachers suggested clusters of those teachers who formed similar groupings of the items, an Hierarchical (H) Grouping Analysis was undertaken in order to delineate these groups more clearly. This is a multivariate clustering technique that examines similarities between profiles and progressively groups the individuals so as to minimize an overall estimation of variation within clusters. In this study, the scores were provided by the coefficients contained in the previously formed intersubject similarity matrix.

The results of the H group analysis carried out on the 93 teachers’ similarity proportions are shown graphically in Figure 1. The number of groups was plotted against potential error increase. The 93 teachers were taken as classified into seven groups since reduction from eight to seven groups produced a marginally greater increase in error than that associated with reduction from six to five groups. The classification check in Table 3 shows that none of the 17 teachers who were clustered into group 4 as a result of collapsing the original groups 6 and 8 would have been more accurately allocated to any of the six remaining groups.

A multiple discriminant analysis was performed to investigate further this sevenfold classification. The number of teachers classified into each of the seven groups after applying the discriminant model is compared in Table 3 with the original allocation by H Grouping.

TABLE 3
NUMBER OF TEACHERS CLASSIFIED INTO GROUPS

Groups Teachers Were Most Like							
H Groups	1	2	3	4	5	6	7
1	6	1			1		
2		15					
3			6				
4				17			
5					24	1	
6					1	11	
7		3				1	6

In Table 3, the initial classification of the 93 teachers is substantially confirmed with only eight misclassifications in groups 1, 5, 6, and 7. No further data were collected from these eight teachers. Because three of the teachers assigned to group 7 more properly belonged to group 2 (and one to group 6), when the F-matrix (Table 4) is examined, groups 2 and 7 cannot be differentiated. Since the critical F-value at the .05 significance level is 2.22 and since all values except those for groups 2 and 7 exceed this critical value, all other groups can be discriminated from one another. There are certainly six, and probably seven, distinctive ways in which subgroups residing in the total sample of 93 teachers construe the teaching of writing.

TABLE 4
INTRA-GROUP F-VALUES

Group	1	2	3	4	5	6
2	3.80					
3	14.74	21.57				
4	14.86	5.98	38.51			
5	2.56	12.78	16.27	40.61		
6	2.68	6.14	18.15	18.69	4.58	
7	2.99	.62	16.18	7.42	6.81	3.80

While the Hierarchical Grouping clustered the teachers so as to maximize their group differences, the stepwise discriminant analysis determined the extent and manner in which these defined groups of subjects could be differentiated. When centroids, or points representing the groups, were located in the discriminant space, they were separated from each other to a maximum degree. The centroid teachers in each group were defined as those with a probability of approximately 1.00 of being located in that group and in no other. Points representing all the other teachers in the sample were also located within the space. Each cluster of teachers thus contained individuals whose sorting behaviours or occupational perspectives on the teaching of writing were similar. The seven resultant groups can be denoted as teacher types. Aitkin et al. (1981) emphasized that clustering methods must be based on the probabilistic nature of cluster membership if they are to have any validity.

Thirty centroid teachers from 18 different high schools were identified. They were invited to have their pupils' progress in writing charted during the next academic year; however, it was possible to proceed with a rational sample of only 15 centroid teachers from nine schools, with all seven groups of constructions still being represented. These teachers, together with the number of categories that they formed, are indicated below in Table 5. These categories are regarded as their personal constructions of the teaching of writing.

TABLE 5
FIFTEEN CENTROID TEACHERS
AND NUMBER OF CONSTRUCTS FORMED

Group	Teacher Code Number	Number of Constructs
1	1004	11
	1901	12
2	0403	13
	2003	13
3	1908	9
	1103	10
4	2201	8
	0705	4
5	1702	10
	2001	13
6	0701	16
	1905	20
	1906	17
7	1301	5
	0405	7

Clinical Analysis and Results

If the more common types of thinking about teaching are to be discussed, statistical investigation of some kind is inescapable; however, clinical methodologies are also needed in order to move even more closely to the dynamic reality of teachers' cognitions. Though the task of abstracting teachers' perspectival styles is not to be underestimated, the 20 nuclear categories or constructs shared to a greater or lesser extent by all of the teachers made it possible to study the similarities and the dissimilarities between the seven kinds of ideational complexes.

The groups were compared by inspecting to see which of the 20 categories they perceived and which they ignored. The items in each category were first examined, however, for the conditional probabilities, as indicated in Table 6, that reveal the nuclear membership. Only constructs XI and XIV did not contain two items with probabilities of at least .85.

For each of the seven groups, when both teachers made these nuclear groupings of items, a tally was kept. The third teacher's sort in group 6 was not used so that the results could be more easily compared; they are presented in Table 7.

All of the groups perceive the two categories relating to the mechanical skills and to warm teacher-student relationships (except group 2 for this latter

construct). These two ideas suggest the traditional and the progressive pedagogies of writing, respectively. From Table 7 it is expected that groups 2 and 4 are to prove less prominent, while groups 5, 6, and 7 are likely to emerge as more so.

TABLE 6
ITEM MEMBERSHIP AND LEVELS OF PROBABILITY

Nuclear Category	Probabilities			
	1.00	.99-.95	.94-.90	.89-.85
	Items	Items	Items	Items
I	17,23,50	45,49		12
II	8,26,58,69		73	
III		44	25,74	
IV	34	28,52		21,66
V		51	54	
VI		2	9,27	
VII	77,80			
VIII	47,53			42
IX		56,60	78	
X		37	38	
XI		5		(6)
XII	3	7	4	
XIII		48,70		
XIV	1			(55)
XV	16,18,19			13
XVI			46	61
XVII	35,36			
XVIII		24	63	
XIX			43	31
XX			22,40	

TABLE 7
NUCLEAR CATEGORIES RECOGNIZED OR NOT
BY EACH GROUP

Group	Number of Categories Perceived	Categories Uniquely Perceived	Categories Perceived by 2 Groups	Categories Perceived by 3 Groups	Categories Not Perceived	Construct System
1	8		Difficulties in Writing; The Best Writing	Deductive Model; Correctness Vs Appropriateness	Motivation	Traditional
2	7			Deductive Model	Motivation; Pupil Talk; Pupils Positive	Traditional
3	9		Motivation	Sense of Audience; Correctness Vs Appropriateness	Pupil Talk	Mixed
4	8			Sense of Audience; Correctness Vs Appropriateness	Motivation; Pupils Positive	Traditional
5	12	Teacher Domination; Current Criticisms	Ideal Teacher of Writing; The Best Writing	Sense of Audience	Motivation; Pupil Talk	Mixed
6	5	Natural Development	Difficulties in Writing	Correctness Vs Appropriateness	Motivation; Pupil Talk; Pupils Positive	Mixed
7	13	Futility of Abstractions	Motivation; Ideal Teacher of Writing	Deductive Model; Sense of Audience		Progressive

Discussion

For teachers of year ten English, the low similarity indices clearly show divisions or segmentation at the level of ideas or constructs. Based on the more distinctive categories formed by the seven groups (see Table 7), a series of vignettes is offered of their ethnoparadigms (Imershein, 1977).

Both teachers in group 1 project a somewhat traditional point of view, dwelling on the best writing and the difficulties posed by writing. Also in a formal transmission mode, the teachers in group 2 are concerned with deductive teaching and matters of correctness. Both teachers in group 3 somewhat ambivalently set motivation and inductive teaching against the deductive model, while those in group 4 appear undecided, teaming a sense of audience with a concern for correctness. These four teachers have either a traditional or perhaps a mixed view of teaching writing. The teachers in group 5, however, are able simultaneously to sustain awareness of four constructs; that is, the current state of the teaching of writing, questions of teacher domination, notions of the ideal teacher of writing, and the intended audience. In contrast, the teachers in group 6 appear to be younger and almost in a state of ideational flux or paradigmatic shift. They combine a progressive appreciation of the natural development of writing with some preoccupation with the difficulties involved in writing, particularly those relating to correctness. Finally, both teachers in group 7 are not only uniquely concerned with the futility of teaching writing by abstract precept, but they are also attuned to concepts of motivation and the ideal teacher. Unlike group 2, this last pair may well have a progressive view of teaching writing. This difference seems pedagogically rather than statistically significant.

Turning to those categories that are ignored, it is seen that only the teachers in group 7 conceive of writing both for pleasure and as a result of motivation. The teachers in groups 2, 3, 5 and 6 fail to attend also to the importance of talk, while those in groups 2, 4 and 6 do not recognize pupils as essentially positive and creative. The teachers of English have been shown to be sensitive to certain aspects of the reality of teaching writing but not to others. William James (1890) aptly depicted the mind as a theatre of simultaneous possibilities with consciousness consisting in the comparison of these with each other, the selection of some, and the suppression of others. The world that teachers feel and work in is that which their teachers and they themselves, by slowly cumulative strokes of choice, have extricated out of this, like sculptors, by simply rejecting certain portions of the stuff of pedagogy. Six of the teacher groups seem to have suppressed the progressive possibilities in teaching writing.

Although group differences exist empirically among English teachers' constructions of teaching writing and sense can be made of the branching within this cognitive community, under an interpretive analysis most of the teacher types seemed somewhat skills-based or traditional in their ideas about the teaching of writing. Such a convergence of interpretational schemes, despite initial expressions of pluralism, requires that some implications be drawn.

Hammersley (1977, p. 112) states that there is a tendency in the classroom for progressive practices to deviate towards more discipline-based teaching as the teacher finds it necessary to demonstrate efficiency and control. The present study has shown a convergence even at the level of paradigm. Berlak and Berlak (1975, pp. 14-15) agree that paradigmatic dilemmas or inconsistencies are normal for teachers since in the course of living they come to accept some contradictory

ideas about the proper relationship between authority and child and about how much discomfort is required for true learning. These basic beliefs are intermixed with other ideas that arise from their experiences of teacher education. To these ideas are added those that derive from the individual teacher's daily experiences with children in school and from the particular constraints of the given school.

Teaching may be like diving with some routines being much more difficult and likely to end in failure. Kremer (1978, p. 993) writes that, while a traditional viewpoint of teaching has well-defined goals that are relatively easy to assess and allow for uniform ways of teaching, progressive goals are heuristic in nature and do not imply specific and clear cut ways of teaching. For example, merely encouraging intending teachers to treat children as resources "is like telling people to be good: it strikes a responsive chord but the sound does not last very long" (Sarason, 1971, p. 195). It does not help merely to tell teachers to accept and respect children and to build on what they are if the teachers do not know how to work with their own classes on a daily basis. No matter how idealistic teachers may be in the beginning, their hopes are soon crushed if they are unable to reflect upon and translate their constructs into practice. They cannot just "stretch out with their feelings."

Without clear guidelines, teachers may well develop a sense of helplessness, a "They Won't Let Me!" mentality, behind which they can shelter in order to justify traditional teaching behaviours (Diamond, 1982). There is a strong possibility that teacher education does not equip intending teachers with the necessary self-direction, understanding, and conceptual tools. Lectures about child-centredness, creativity, and tolerance may need to be supported by training which works through and models these processes. As one of the representative teachers explained,

Most of my ideas started at college but I just didn't understand them then. Trainee teachers often don't understand their college "gear." Especially in your first years you reproduce the teaching you experienced. You try to emulate your teachers and what works.

Conclusion

One difficulty with the present study is that using groups of teachers rather than individuals as the unit of analysis tends to mask relationships and to yield a smaller volume of important information (Good, Biddle & Brophy, 1975, p. 44). In order to retain the richness of teacher perceptions, the free-sort of each centroid teacher needs to be inspected. However, it is difficult to analyse such involved data in a replicable way. Individual multidimensional scaling may be particularly suited to such a situation.

While the present study has been concerned with the differentiation of English teachers' thinking about the teaching of writing, the integration and articulation of such structures also need to be explored. It may be that a teacher's professional socialization and development may be interpreted not as the mere accretion of more and more pieces of information but as the growth of an increasingly complex structure for clearly organizing and interpenetrating ideas with unifying insight.

Since fewer pedagogically than statistically significant differences were found in teachers' perspectives, teacher education courses may need to follow the

strategies they advocate and to make their theory become their practice; that is, if teachers are to differ at all in their constructions of teaching. Unless personalised and child centred teaching can be seen to be implemented, it may remain at the level of rhetoric. As another teacher explained,

It's very frustrating not being able to put your ideas into practice. It makes you go back to safer ideas. You pull back. If you're not sure of your ground, I guess you just go back. Ideas are so amorphous.

References

- Aitkin, M., Bennett, S. N., & Hesketh, J. Teaching styles and pupil progress: A re-analysis. *British Journal of Educational Psychology*, 1981, 51, 170-185.
- Ashton, P., Kneen, P., Davies, F., & Holley, B. J. *The aims of primary education*. London: Macmillan, 1975.
- Barker-Lunn, J. *Streaming in the primary school*. Slough: National Foundation for Educational Research, 1970.
- Barnes, D., & Shemilt, D. Transmission and interpretation. *Educational Review*, 1974, 26(3), 213-228.
- Bennett, N., Jordan, J., Long, G., & Wade, B. *Teaching styles and pupil progress*. London: Open Books, 1976.
- Berlak, H., & Berlak, A. Toward a political and social-psychological theory of schooling. *Interchange*, 1975, 6(3), 11-21.
- Brophy, J. E., & Evertson, C. M. *Process-product correlations in the Texas Teacher Effectiveness Study: Final report*. Austin: University of Texas, 1974.
- Combs, A. W., & Soper, D. W. The perceptual organization of effective counselors. *Journal of Counselling Psychology*, 1963, 10(3) 222-226.
- Cyphert, F. R. An analysis of research in teacher education. *Journal of Teacher Education*, 1972, 23(2), 145-151.
- Diamond, C. T. P. The skills or growth: English teachers' thinking about the teaching of writing. *English in Australia*, 1979, 48, 57-66.
- Diamond, C. T. P. A note on measuring teachers' constructs. *Research in the Teaching of English*, 1980, 14(2), 161-164.
- Diamond, C. T. P. "You always end up with conflict": An account of constraints in teaching written composition. In R. D. Eagleson (Ed.), *English in the eighties: Conference papers*. Sydney: Australian Association for the Teaching of English, 1982.
- Evans, G. T. The analysis of categorizing behaviour. *Psychometrika*, 1970, 35(3), 367-392.
- Good, T. L., Biddle, B. J., & Brophy, J. E. *Teachers make a difference*. New York: Holt, 1975.
- Gray, J., & Satterly, D. Formal or informal? A re-assessment of the British evidence. *British Journal of Educational Psychology*, 1981, 51, 187-196.
- Hammersley, M. *Teacher perspectives*. London: Open University Press, 1977.
- Imershein, A. W. The epistemological bases of social order: Toward ethnoparadigm analysis. In D. R. Heise (Ed.), *Sociological Methodology*. San Francisco: Jossey-Boss, 1977.
- James, W. *The principles of psychology*. New York: Dover, 1950 (original, 1890).

- Kelly, G. A. *The psychology of personal constructs*. New York: Norton, 1955.
- Kerlinger, F. N. Progressivism and traditionalism. *Journal of Social Psychology*, 1958, 48, 111-135.
- Kerlinger, F. N. The first and second-order factor structures of attitudes toward education. *American Educational Research Journal*, 1967, 4(3), 191-205.
- Kremer, L. Teachers' attitudes toward educational goals. *Journal of Educational Psychology*, 1978, 70(6), 993-997.
- Miller, P. J. Teachers' opinions and the ideational basis of education. *Alberta Journal of Educational Research*, 1981, 27(2), 182-191.
- Miller, D. M., et al. *Elementary school teachers' viewpoints of classroom teaching and learning*. Report, United States Office of Education, University of Wisconsin, 1967.
- Rosenshine, B. Classroom instruction. In N. L. Gage (Ed.), *The psychology of teaching methods*. Chicago: National Society for the Study of Education, 1976.
- Runkel, P. J. Cognition similarity in facilitating communication. *Sociometry*, 1956, 19, 178-191.
- Runkel, P. J., & Damrin, D. E. Effects of training and anxiety upon teachers' preferences for information about students. *Journal of Educational Psychology*, 1961, 52(5), 254-261.
- Sarason, S. B. *The culture of the school and the problem of change*. Boston: Allyn and Bacon, 1971.
- Smith, L. M., & Geoffrey, W. *The complexities of the urban classroom*. New York: Holt, 1968.
- Soar, R. S. *Follow through classroom process measurement and pupil growth — 1970-1971: Final report*. Gainesville: University of Florida, 1973.
- Sontag, M. Attitudes toward education and perception of teacher behaviours. *American Educational Research Journal*, 1968, 5(3), 385-401.
- Stallings, J. A., & Kaskowitz, D. H. *Follow through classroom observation evaluation — 1972-1973*. Menlo Park: Stanford Research Institute, 1974.
- Triandis, H. C. Cognitive similarity and interpersonal communication in industry. *Journal of Applied Psychology*, 1959, 43, 321-326.
- Wiley, D. E. Latent partition analysis. *Psychometrika*, 1967, 32(2), 183-194.

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The Effect of School Management Patterns on Organizational Effectiveness

This study contains a description and discussion of an investigation of the relationship between principal-teacher-student interaction and school effectiveness. The theoretical model developed by Rensis Likert was utilized to study school interaction. The interaction-influence theory postulated by Likert predicts different relationships among management patterns, group performance and organizational effectiveness. The need-press theory of George Stern was utilized as the criterion of effectiveness. From results of the study, it is suggested that leadership in the school has an effect on organizational effectiveness and that implementation of a system four management pattern could lead to an improved environment for students.

The organization and administration of schools is a perpetual concern to decision makers in education. Insights into the nature of effective management are of paramount importance to leadership theorists. Indicators of organizational effectiveness could provide direct benefit to educators as well as to students. The study (Donnelly, 1980) reported in this paper was designed to test and evaluate one theory of leadership effectiveness.

The Management Pattern Model

Rensis Likert and his colleagues at the University of Michigan's Institute for Social Research have spent more than three decades studying issues surrounding effectiveness and adaptability in different types of organizations. More recently, management systems of educational organizations have been investigated at this institution. The management systems theory states that the management pattern of an organization can be placed on a continuum somewhere between a most

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primitive style and a most socially evolved pattern. The theory predicts different relationships among management patterns, group performance and organizational effectiveness.

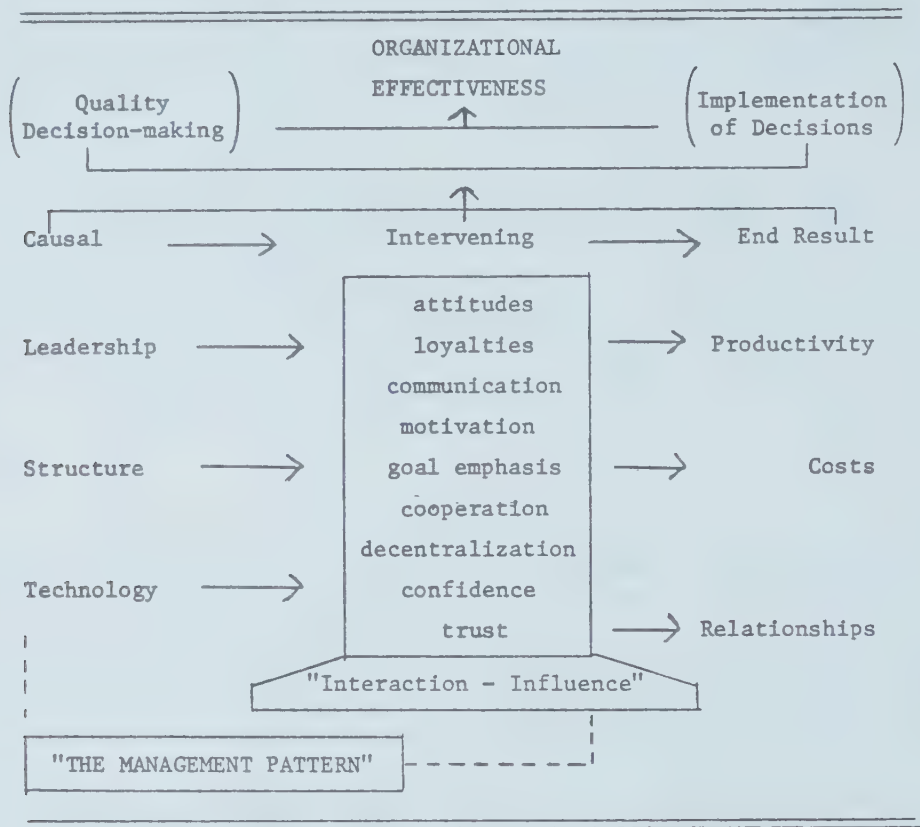


Figure 1. Likert's Interaction-Influence Theory.

Figure 1 illustrates the main concepts of Likert's interaction influence theory. It suggests that the effectiveness of any working group is proportional to the combined ability of its members to make and implement quality decisions. Likert has identified causal, intervening and end-result variables as the three main categories of elements acting upon this two-fold decision process.

The causal variables are those over which the management has at least partial control. They include leadership, structure (ways in which organizational components are organized to communicate with each other), and technology. The intervening variables refer to the conditions that exist among the members of the work group. In the case of schools, this set of variables describes the social relationships among teachers as well as the disposition of the teacher toward the overall work situation. A well developed social system would be characterized by highly positive ratings on the intervening variables of attitudes through trust. Likert has also demonstrated that the social system, and hence the intervening variables, improves in direct proportion to the amount of interaction and the degree of influence perceived by subordinates. The end result variables are the output measures or the effectiveness measures of the organization. The arrows of the figure illustrate the sequential relationships among the three sets of variables. Causal inputs are mediated through the intervening system to produce end results that can be categorized as relating to productivity costs or relationships. If the

leadership is strong, the structure appropriate, and the technology available, the resultant intervening social system will not only be capable of producing highly desirable end results, but also will be able, as Likert has shown, to make adaptations that are necessary to maintain a high level of effectiveness.

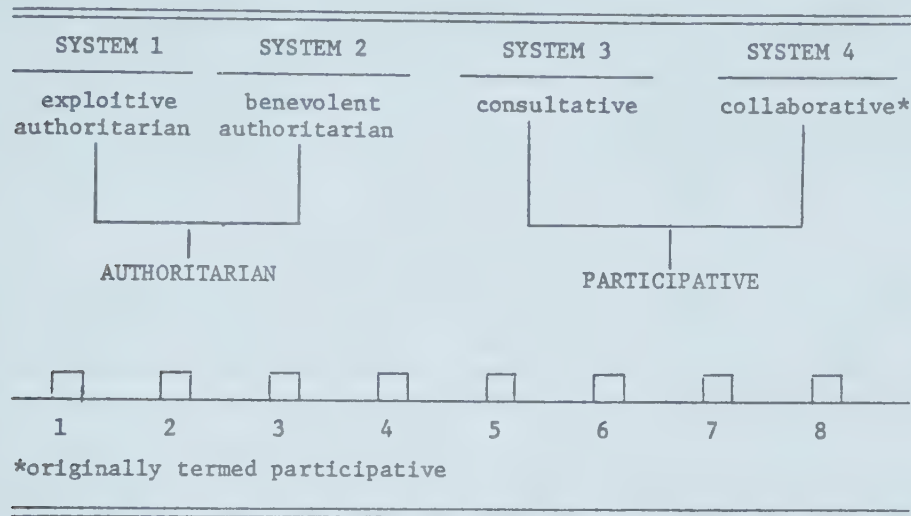


Figure 2. The Likert system's model.

Figure 2 illustrates the relative terminology used to describe the four systems of Likert's management theory. The most primitive style of management is characterized as authoritarian while the most socially evolved is described as participatory.

The exploitive-authoritarian approach to management concentrates on practices that place decision, direction, and surveillance in the hands of management. Employees are considered to be a market commodity and their time and labour is thought to be purchased solely for the benefit of the organization. Decision-making is a prerogative of the senior management personnel who use downward communication to direct the activities of subordinates. Motivation is based on the external use of fear and punishment. Performance tends to be mediocre.

The benevolent-authoritarian approach to management is much like the exploitive system in that its major assumptions still place most of the authority in the hands of the superiors. Its means of motivation, however, are less coercive than the former because it rewards people with a system of incentives based on individual competition and isolation. Supervision is still done on an individual basis but some upward communication and consultation are accepted. While this method still expects employee subservience, attempts are made to remove some of the aspects of the coercive system that subordinates find annoying.

Management in a system three organization still reserves the right to decision-making and directing of the organization but it differs in a number of ways from the previous systems. Employees are no longer looked upon as market commodities; much of the surveillance is removed, little coercion exists and valid two-way communication is maintained by a person-to-person consultative relationship between subordinates and their immediate superiors. Motivation emphasizes positive approaches, more responsibility is delegated to lower level managers, and all individuals within the organization are encouraged to become

accomplished specialists. This atmosphere encourages managers and their subordinates to be reasonably committed to the organizational purposes. Cost factors, performance levels, and employee satisfaction tend to be good.

In the collaborative system, employees and managers both exert control over the work situation. Based on an interaction influence model, management views employees to be an important element in the decision-making process. The manager's function becomes one that facilitates the process more than one of actual decision-making. Overlapping organizational structures, multiple group memberships, team approaches to problem-solving, open communication, easy access to information, mutual trust and cooperation provide a climate of willing participation that capitalizes on the expertise of all concerned. This system is characterized by good labour relations and high performance outputs.

The management pattern of an organization can be operationally defined as the score obtained on the "Profile of Organizational Characteristics" (Likert Associates, 1972). This instrument was developed by Likert to measure organizational concepts that had been theoretically derived from research in business organizations. In 1968 Likert developed an instrument to measure the management pattern of educational organizations. The instrument has gone through several revisions and has resulted in the Profile of a School Questionnaire.

The Application of the Model to School Effectiveness

Likert suggests that causal variables are mediated through the intervening variables to produce end results. The end result variables are the determining factors of effectiveness. MacKillican (1975) made this concept operational by outlining the relationship between two levels within a school.

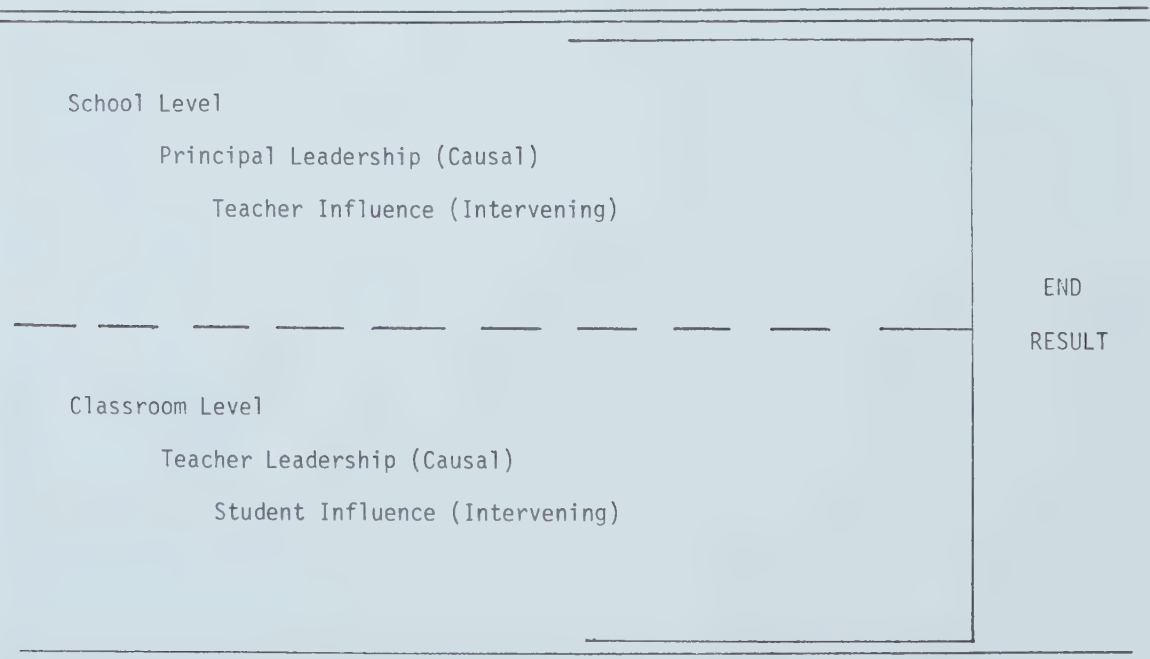


Figure 3. Theoretical relationship between the two levels of leadership and influence.

As indicated in Figure 3, leaders within a school (principals) create a management pattern that permits reciprocal influence by teachers. This in turn generates teacher leadership that creates a management pattern at the classroom level which engenders student influence. These patterns, at the school level and the classroom level, collectively affect end results. The end result becomes a measure of organizational effectiveness. In an investigation of the contingency model of leadership, Garland and O'Reilly (1976) advocate the use of Likert's model to study organizational effectiveness. Researchers at that time suggested that Likert represented a dominant tradition in the field of leadership theory and organizational analysis.

A Measure of Organizational Effectiveness

The researchers wished to select a technique which captured a variety of output variables in different schools. In addition it was essential that the theoretical system for the measure be compatible with Likert's theory. The index of organizational effectiveness had to be defensible in view of Likert's concept of causal, intervening, and end result variables.

A primary function of a school staff is to create a school environment which will foster self-actualization in students (Stern, 1971). This position departs from the traditional view of school effectiveness centering upon academic achievement usually demonstrated by high scores on standardized tests. These test results are related to the presumed central purpose of the school which is to develop the rational power of students. It is suggested that this central purpose is subordinated to major values of individual dignity and human progress (Weinstein & Fantini, 1970). A learning environment which fosters self-actualization of students is a reliable measure of success in an educational organization (Combs, 1970). This view was supported by Bloom (1972) in an article where he argues that we can best serve education and society by providing an environment which takes care of the educational needs of students. Bishop (1972) also supports the view that the staff of a school must accept major responsibility for the sociopsychological climate for learning which pupils perceive in a school.

To conceptualize the idea of school environments it was necessary to locate a theory which deals with a multitude of variables including both latent and manifest functions of staff effort. Stern's extension of Murray's (1938) need-press theory provides a comprehensive model for studying environments in relation to psychogenic needs. Stern (1970) based his theory on the perception of press. He suggests that personality needs are transposed to environmental counterparts or press. Behaviour and personality development occur when environmental variables act as stimuli through the medium of perception. Press varies from hindering the development of a need to facilitating the need. Therefore, an effective environment would facilitate the development of needs which are characteristic of a self-actualizing person.

There is compatibility between the theory of Likert and the theory of Stern. The relationships are found in the similarity of constructs and in the conceptualization of the process of activity in terms of causal, intervening, and end-result variables. Both theories utilize as a common base the construct of need. Likert (1976) notes the tendency of human energy to be allocated to the satisfaction of prepotent needs and, in particular, self-actualization needs when lower order needs have been met. Likert suggests that the inherent desire to

achieve and maintain a sense of personal worth and importance is the motive source for a variety of needs. Stern (1970) defined need as “organizational tendencies which appear to give unity and direction to a person’s behavior” (p. 6). Thus, in both theories, needs motivate behavior and are inferred from activity. The leadership of the principal creates a group atmosphere at the staff level. Each teacher creates a classroom environment which creates press for students. The school is effective to the extent that these press characteristics represent a self-actualizing environment.

Stern (1970) developed the High School Characteristics Index (HSCI) on the basis of the need-press model. The HSCI is designed to measure the degree to which schools provide a self-actualizing experience for adolescent students. More recently Stern and Walker (1973) developed the Classroom Environment Index (CEI) to measure the effectiveness of the elementary school environment as perceived by students. The CEI consists of thirty scales which represent external environmental counterparts of the thirty personality needs used by Stern in developing his previous instruments. In validation studies Stern and Walker (1973) derived six first-order factors. They indicate that factors one to four represent developmental press which describes conditions that facilitate growth and development. Factors five and six deal with control press which refers to organizational control and maintenance. The developmental factors arranged in relation to the control factors are as follows.

Developmental Press

1. *Humanistic Intellectual Climate.* This factor reflects the qualities of a staff and plant specifically devoted to scholarly activities in the humanities, arts and social sciences. It includes aspects of achievement together with elements of contemplation and social concern.
2. *Group Intellectual Life.* Classrooms high on this factor are characterized by fun-loving, friendly, actively outgoing environments which provide for mutually supportive group activities. It includes aspects of intellectuality, reflectiveness, objective thinking, and practicality.
3. *Achievement Standards.* This factor is characterized by high standards of achievement, an emphasis on striving for success through personal effort and on planned, purposeful and organized activities. A degree of intense emotional expression is in evidence.
4. *Personal Dignity.* Classrooms scoring high on this factor are characterized by a stress on individual responsibility and personal autonomy. Tolerance, self-confidence and friendliness are also evident.

Control Press

5. *Orderliness.* This factor reflects an emphasis on organization and structure within the academic environment along with administrative concern for the physical well being of students. Caution and seriousness are evident.

6. *Non-science.* This factor reflects environments with an absence of an interest in the natural sciences together with a lack of aspects associated with sexuality and egotism (Stern & Walker, 1973).

The theoretically effective environment is characterized by high scores on the Developmental Press factors and low scores on the Control Press factors. According to Stern and Walker, this pattern represents a self-actualizing environment. Using the CEI, researchers are able to ascertain if a classroom environment is present which facilitates optimum development of human capacities.

Throughout the work by Stern and then by Stern and Walker, the need-press model proposed by Murray was utilized. Their work has culminated in several instruments, namely the Activity Index, College Characteristics Index (CCI), and the Organizational Climate Index (OCI). The CEI appeared to be an appropriate index of classroom effectiveness to be used within the context of Likert's theory.

The Research Problem, Design and Hypotheses.

The theoretical rationale for the study was based on Likert's theory of management patterns and the Stern need-press model. As indicated earlier there is a fundamental relationship between the two theories and both are compatible with a number of administrative theories. Schools differ in terms of the type of management pattern prevalent in the organization. These patterns have been arrayed on a continuum from Exploitive Authoritarian to Participatory. The theoretical relationships that exist among causal, intervening and end-result variables enable one to predict a positive relationship between the management pattern system score and the developmental press score. An examination of data available from previous research indicates that there would be a need to test the relationship between management system and press. It was predicted that there would be a difference in effectiveness between elementary schools with high management pattern scores and schools with low school management scores.

The variables of the study were school management patterns and classroom effectiveness.

Procedure

The data collection involved two phases. In stage one, the Likert and Likert Profile of a School instrument was distributed to 288 teachers randomly selected in 24 schools. Likert has indicated that a sample of eight to ten teachers within a school would represent an adequate measure of School management practices. Each school was required to have a minimum of 14 teachers and to offer a program to grade seven and eight students. In addition each principal was to have been in the school for a period of at least two years. Likert (1972) suggests that principals should be in a school for at least two years before an organizational climate inventory is completed.

Schools which produced high or low scores on the Profile of a School Questionnaire were used to indicate the polar extremities of the continuum represented in Likert's theory. The low SMP (School Management Pattern) schools were defined as those schools in the initial sample with the lower quartile score. The SMP scores for these institutions ranged from 4.93 to 5.35. Since Likert (1972) provided a mean score of 5.36, all of these schools registered below

the comparable mean. The high SMP schools were those above the upper quartile score. These schools had SMP scores ranging from 5.91 to 6.42.

The second phase of the study involved the collection of criterion data on school effectiveness. Data were obtained from students in classrooms of the schools that scored high or low on the Profile of the School Questionnaire. A total of 561 student responses were utilized in the second stage of the study. The students were administered the Classroom Environment Index developed by Stern and Walker. There were six schools classified as high SMP schools and five classified as low SMP schools. Classrooms were randomly selected within each school, one grade seven class and one grade eight class.

Scales

The Profile of a School instrument was used to measure School Management Patterns (SMP). The score obtained is a measure of teacher perception of the way in which a school is managed. Likert adapted the Profile of a School Questionnaire from a similar instrument used by business organizations to compare certain variables with organizational effectiveness. The original Profile of Organizational Characteristics was empirically tested against such organizational variables as productivity, employee turnover, cost factors, employee motivation, labour relations, and profit margins. The validity of the profile was concluded from its accurate ability to predict organizational outcomes or end-results from a measure of internal conditions. Reliability scores from these studies ranged from .7 to .9. The Profile of a School indicated split-half reliabilities .90 to .95 (Likert, 1972).

Although the quantity of studies in school settings has lagged behind those in business, several have confirmed this instrument's validity as an accurate predictor of such desirable school outcomes as high school achievement, teacher satisfaction, decreased teacher strikes, high student satisfaction, and less school vandalism.

The Classroom Environment Index was used to measure the effectiveness of the elementary school environment as perceived by students. The CEI consists of 30 scales which represent environmental counterparts of the 30 personality needs used by Stern in the development of the index. Each of the 30 scales of the CEI consists of 10 items making a sum of 300. Stern (1973) has reported reliability coefficients for the six first-order factors ranging from .56 to .85.

Hypotheses

The hypotheses were derived from the theory presented in the first part of this paper. The major hypothesis provided a direct test of Likert's theory and Stern's model of effectiveness.

1. High School Management Pattern elementary schools will score significantly higher than Low School Management Pattern elementary schools in the Developmental Press scores, Humanistic Intellectual Climate, Group Intellectual Life, Achievement Standard, and Personal Dignity, and lower on the Control Press Orderliness and Non-science.

A review of the literature suggested that the following hypotheses should be supported.

- 2. There is no difference between grade levels and student perception of environmental press.
- 3. There is no difference between sex classification and student perception of environmental press.
- 4. There is no difference in environmental press between schools within High School Management Pattern Schools.
- 5. There is no difference in environmental press between schools within Low School Management Pattern Schools.

Analyses

The statistical treatment for the analyses was multivariate analysis of variance with sex and grade level as blocking variables and the sex CEI factor mean scores as the variates. These mean scores were generated from the 30 scale scores of the CEI and scored at the University of Syracuse. The analysis was done within the full rank linear model approach (Carlson & Tim, 1974) using the generalized variance ratio statistic.

TABLE 1
CLASSROOM ENVIRONMENT INDEX SCORES

Factor (Press)	High SMP Schools	Low SMP Schools
Humanistic Intellectual Climate	29.665	28.917
Group Intellectual Life	29.574	28.336
Achievement Standards	26.442	25.292
Personal Dignity	29.110	29.097
Orderliness	22.513	22.896
Non-Science	14.773	14.913

The test of the first hypothesis indicated that the differences in perception of press between high and low SMP schools is significant at the .0001 level. The mean scores for the first four factors which Stern called Developmental Press are 114.694 in high SMP schools and 111.642 in low SMP schools. The mean scores

for factors five and six which Stern called Control Press were 37.80 in high SMP schools and 38.03 in low SMP schools. Therefore students in high SMP schools perceive the environment to be higher in developmental press and lower in control press than students in low SMP schools. The mean difference between high and low SMP schools differed significantly for all six factors, as shown in Table 3.

TABLE 2

F RATIOS FOR CLASSROOM ENVIRONMENT INDEX

Hypotheses	df 1	df 2	F	p
H1 (SMP)	6	514	194.587	.0001
H2 (Grade)	6	514	2.881	.0090
H3 (Sex)	6	514	.594	.7355
H4 (School High SMP)	30	2058	3.141	.0001
H5 (School Low SMP)	24	1799	4.873	.0001

TABLE 3

F RATIOS FOR INTERNAL FACTORS

CEI Factor	df 1	df 2	F	p
1. Humanistic Intellectual Climate	1	519	344.696	.0001
2. Group Intellectual Life	1	519	281.345	.0001
3. Achievement Standards	1	519	390.337	.0001
4. Personal Dignity	1	519	298.216	.0001
5. Orderliness	1	519	170.208	.0001
6. Non-Science	1	519	108.537	.0001

The multivariate *F* ratio for the second hypothesis was significant at the .0090 level. Mean scores suggest that grade seven students tended to see a more positive environmental press than did grade eight students. The mean developmental press score for grade seven students was 115.11 and for grade eight students 113.23. Interestingly, the control mean press score for grade seven was 37.60 and for grade eight, 37.46.

The multivariate *F* ratio for the third hypothesis was not significant. Schools with high SMP and schools with low SMP did not differ in effectiveness as far as the sex of the student is concerned. There was not a marked difference between the environmental press as perceived by boys or by girls.

The fourth hypothesis indicated a significant difference of $p=.0001$ between the six schools nested within high SMP. The univariate F Ratios indicated that the significant differences were accounted for by Group Intellectual Climate, Achievement Standards, and the Control Press factors Orderliness and Non-Science. The results are shown in Table 4.

TABLE 4
 F RATIOS FOR NESTED FACTORS—HIGH SMP

CEI Factor	df 1	df 2	F	p
1. Human Intellectual Climate	5	519	1.429	.2120
2. Group Intellectual Life	5	519	5.758	.0001
3. Achievement Standards	5	519	3.164	.0080
4. Personal Dignity	5	519	1.352	.2409
5. Orderliness	5	519	3.608	.0032
6. Non-Science	5	519	3.973	.0015

The test of the fifth hypothesis indicated that the differences between schools nested within low SMP schools was also significant. As in high SMP schools, most of the differences were found in Group Intellectual Life, Achievement Standards, Personal Dignity, Orderliness, and Non-Science. Results are shown in Table 5.

TABLE 5
 F RATIOS FOR NESTED FACTORS—LOW SMP

CEI Factor	df 1	df 2	F	p
1. Human Intellectual Life	4	519	2.586	.0362
2. Group Intellectual Life	4	519	11.620	.0001
3. Achievement Standards	4	519	4.756	.0009
4. Personal Dignity	4	519	4.634	.0011
5. Orderliness	4	519	4.211	.0023
6. Non-Science	4	519	4.838	.0008

Discussion

The study was undertaken to investigate the relationship between teacher and student perceptions of school environments. The study provided a test of Likert's School Management Patterns theory and Stern's need-press model. Likert has suggested that the process of activity in an organization takes place in terms of causal, intervening, and end-result variables. Utilizing this framework, leadership was conceptualized as a causal variable, school management pattern as an

intervening variable, and student perception of the school environment as an end-result variable. Evidence was presented indicating that the relationship between causal and end-result variables is mediated by intervening variables. This study supports that contention. Using the concept of press it was shown that high SMP schools were perceived to be more effective than low SMP schools. High SMP schools were indicative of high developmental press. Schools perceived to be effectively led in terms of the Likert model were perceived to have an environment fostering high developmental press.

Similarly, schools reflecting high SMP scores were hypothesized to have a lower control press climate than schools with low SMP scores. The hypothesis was substantiated. Schools with leaders that fostered management patterns in system three or four in the Likert model created an environment which students perceived to be low in control press. Earlier studies (Appleberry & Hoy, 1969) using the Pupil Control Ideology model support the findings of this study. More autocratic management patterns with a low degree of interaction influence were related to higher normative control in terms of students.

An earlier study by Garland (1973) which utilized the Fiedler contingency model did not substantiate the predicted relationships between LPC scores and effectiveness scores. The authors at that time suggested that the Likert model might be more appropriate for testing such a relationship. It appears that the conceptual framework involving the intricate relationships among causal, intervening, and end-result variables enables the researcher to predict possible outcomes. Schools which are attempting to facilitate student development by creating an environment conducive to student growth should look carefully at the interaction influence model proposed by Likert and investigated in this study.

Although the data in this study did support the theory in the predicted direction, the differences were not as pronounced as one would suspect. This is probably due to the type of schools investigated in the study. The data were collected in the month of June, therefore many of the students had only been in the school for one year. It is possible that it takes at least one academic year for students to accurately describe the learning environment. This factor does not explain the lower score for grade eight pupils on developmental press. Part of the answer may be in the age of students. Grade seven students often are involved in rotary subject patterns for the first time. They may see the experiences as encouraging self-control and self-discipline thus leading them to perceive high developmental press. On the other hand grade eight students were completing their second year in the school and anticipating promotion to a high school. Therefore the students may have looked back at the school year and underestimated the level of developmental press. The finding of differences between grades in this study conflicts with the conclusions reached by Wright (1970) who found no differences. Different organizational patterns between the schools in the two studies could explain some of the discrepancy. The use of a more recent instrument with more sophisticated factors probably allowed the current researchers to detect differences. In practical overtones, one could question the actual school programs in the present study and ascertain if sufficient change was apparent between the grade seven and grade eight classes.

The sex differences of students did not contribute to significant findings in perception of press. As indicated, earlier studies found differences between the press scores perceived by boys and by girls. The findings in this study may reflect the current deemphasis on sex-role stereotyping. An earlier study by Walsh (1977)

found differences in the self-concept of boys and girls in environments similar to those in this investigation. Although one could infer that this affects perception, it may be that the relationship between self-concept and perceptions of environment are less marked according to the sex of students. All students in the present study were following similar programs. There was no attempt to separate any classes on the basis of sex. It appears that our finding of no significant differences strengthens the validity of the CEI to discriminate among classrooms.

The last two hypotheses predicted no differences in perception of press among schools nested within either high SMP or low SMP. As indicated earlier, these hypotheses were not supported. One study reported by Winfrey (1963) supported the findings of the present investigation. His data were collected in high schools in Minnesota. The significant findings of between-school differences within high and low SMP suggest a need to examine individual schools for variables that were not controlled in the present study.

Although it has been suggested that the Profile of a School and the CEI are in some respects both measures of organizational climates there is evidence to indicate that they are measuring different variables. The Likert instrument measures organizational components such as decision-making strategies, communication processes, and motivational techniques. On the other hand the CEI is a measure of affective relationships. It does not imply the existence of managerial strategies or specific organizational practices. This aspect was confirmed in a paper presented by Stern and Walker (1973). Therefore it is apparent that major differences exist between the Profile of a School and the CEI scales.

Conclusion

Rensis Likert's generalized model of the administrative process has proven useful in studying various aspects of school organization. He has suggested that schools with system three or four management patterns demonstrate processes necessary to effect quality decisions. This study was an attempt to demonstrate that intermediate schools which implement the processes suggested by Likert should create a positive learning environment. The need-press model developed by Stern and Walker was utilized as a criterion measure. A relationship between high SMP and developmental press was hypothesized and substantiated. The results suggest that leaders may have an indirect influence on organizational effectiveness. Using the Likert model this influence is transcribed from causal through intervening to end-result variables. The model provides a much-needed framework which enables researchers to investigate the complex relationships prevalent in schools. Thorough study of the Likert writings will enable administrators to devise strategies for implementing a High School Management Pattern organization. Results of this study suggest that the implementation of such strategies could lead to an improved environment for students.

References

- Appleberry, J. B., & Hoy, W. K. The Pupil Control Ideology of professional personnel in open and closed elementary schools. *Educational Administration Quarterly*, 1969, 5, 74-85.

- Bishop, L. K. *Individualizing educational systems*. New York: Harper and Row, 1972, 220.
- Carlson, J. E. *Full rank multivariate linear model computer program*. University of Ottawa, 1979.
- Carlson, J. E., & Tim, N. H. *Full rank univariate linear model computer program manual*. University of Pittsburgh, 1974.
- Combs, A. W. An educational imperative. The human dimension. In M. M. Scobey & G. Graham (Eds.), *To nurture humaneness: Commitment for the 70's*. Washington: ASCD, 1970, 185.
- Donnelly, B. *The relationship between school management patterns and environmental press on students in grades seven and eight*. Doctoral dissertation, University of Ottawa, 1980.
- Fiedler, F. E. *A theory of leadership effectiveness*. New York: McGraw-Hill, 1967.
- Garland, P. *The effect of principal-teacher interaction on secondary school environments; an empirical study*. Unpublished doctoral dissertation, University of Ottawa, 1973.
- Garland, P., & O'Reilly, R. The effect of leader-member interaction on organizational effectiveness. *Educational Administration Quarterly*, 1976, 12(3), 9-30.
- Likert Associates. The Likert profile of a school, New survey instruments for public schools to improve organizational effectiveness, *Manual for questionnaire use*. Ann Arbor, Michigan, 1972, 14.
- Likert, R. *New patterns of management*. New York: McGraw-Hill, 1961.
- Likert, R. *The human organization. Its management and values*. New York: McGraw-Hill, 1967.
- Likert, R. *New ways of managing conflict*. New York: McGraw-Hill, 1967.
- Likert, R. Past and future perspective on System 4. Paper presented to the Academy of Management Conference, Orlando, Florida, August, 1977.
- Likert, R. Evidence of the effectiveness of system in school administration. *Research Report*. Ann Arbor, Michigan: Likert Associates, 1978.
- Likert, R., & Siepert, A. The Likert profile of a school measures of the human organization. Paper presented to the American Educational Research Association, New Orleans, February, 1973.
- MacKillican, W. *An empirical study of the relationship between school management patterns and the change toward classroom openness*. Unpublished doctoral dissertation, University of Ottawa, 1975.
- Murray, H. A. *Explorations in personality*. New York: Oxford University Press, 1938.
- Stern, G. S. *People in context*. Toronto: John Wiley, 1970.
- Stern G. S. Self-actualizing environments for students. *School Review*, 1971, Winter.

- Stern, G. S., & Walker, W. J. The measurement of classroom environmental press. Paper presented to American Educational Research Association, New Orleans, February, 1973.
- Walsh, A. J. K. *A descriptive analysis of self-concept of middle high school students in Michigan*. Unpublished doctoral dissertation, Michigan State University, 1977.
- Weinstein, G., & Fantini, M. (Eds.). *Toward humanistic education: A curriculum of effect*. New York: Praegar Publications, 1970, 28.
- Winfrey, J. K. *The appraisal of institutional press as perceived by selected groups of Minneapolis area high school students*. Unpublished doctoral dissertation, University of Minnesota, Minneapolis, 1963.
- Wright, W. R. *Environmental press as perceived by high school students*. Unpublished doctoral dissertation, Purdue University, Lafayette, 1970.

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The Effects of Principal Participation in Curriculum Implementation: Support from an Evaluation of a New Mathematics Curriculum

Curriculum writers often find putting ideas on paper much easier than mapping them into teachers' programs. Contextual factors influence outcomes of curriculum changes in unpredictable ways. One such factor surfaced in an investigation to measure the effects of implementing a new grade 6 mathematics curriculum across the 61 schools of one school board. Analysis of gains in student achievement scores revealed a positive effect of the new mathematics program but also a Program x School interaction. Evidence is presented that the more involved the principal was in the adoption process of the new curriculum, the more the school utilized mathematics consultants and the more the students gained in achievement scores from pretest to posttest. Analysis of extreme values strengthens the interpretation that the principal's leadership is a key factor in a school's performance.

Identifying and anticipating the factors influencing curriculum implementation requires paramount consideration if new programs are to be adopted into the

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classroom successfully. Patterson and Czajkowski (1979) have observed that curriculum changes are not fully integrated into the classroom because the change agent does not adequately attend to implementation.

The problem of curriculum implementation appears to be a universal one, judging from the numerous studies that have addressed themselves to this issue (Frey, 1979; Mahan, 1972; McNeil, 1977; Nachtigal, 1972). Irrespective of which model curriculum developers have chosen to modify, it is clear that there has often been a lack of attention given to the implementation phase (Berman, 1977; Loukes, 1979; Mann, 1978; Patterson & Czajkowski, 1979). Unused curricula are skeletons in the closets of many boards of education. The less than satisfactory adoption of new ideas may not necessarily be in the quality of the new programs but rather in the superficiality of their implementation.

Effects of Principal's Leadership on Pupil Achievement

Articles on the implementation process abound in current educational research. Since the comprehensive Fullan and Pomfret (1977) review, we have seen books and articles in large numbers (e.g., House, 1979). Attention has been focussed, appropriately, on the principal players — teachers, curriculum consultants, and, where present, characteristic leaders (House, 1979, p. 3). There are so many players in any large curriculum implementation, however, that influences and roles will always be difficult to detect.

One such large effort was a change to a new core mathematics curriculum at the grade 6 level across 61 schools in one school board in southwestern Ontario. The curriculum work and the evaluation of the change has been reported elsewhere (Pravica, 1977). One outcome of that evaluation was evidence of a continuum of leadership from the principal in such a change (inactive to continual involvement and support) and a detectable influence of that leadership on pupil achievement.

The Curriculum Change and Evaluation

A new core mathematics program was written, field tested, and prepared for implementation during the 1974-75 school year. Teachers were introduced to the program of study during professional development days in the latter part of June 1975, when they were given the opportunity to examine the material critically and to discuss concerns. The program was introduced in all schools in the 1975-76 school year. Consultants were available during the school year to assist teachers in the adoption process.

To evaluate the new program, the entire population of grade 6 students was tested in May 1975 (pretest) and all the following year's grade 6 students in May 1976 (posttest), using specially developed criterion-referenced multiple choice item tests designed to be sensitive to outcomes of the new curriculum (Pravica, 1977). This involved 3825 students in May 1975 and 3865 students in May 1976 (with a parallel test).

The Dominion Learning Capacity Intermediate Level Form A and the Canadian Test of Basic Skills (CTBS) were also administered to the two successive grade 6 cohorts. The mean I.Q. score for the pretest group was marginally, but significantly, higher ($t=4.04$, $df=6983$). No significant differences between cohorts were found either on the CTBS Test of Basic Math Concepts ($t=1.65$) or Problem Solving ($t=1.68$). The 1975 cohort scored significantly higher

on the Modern Math Supplement ($t=3.24$). Since the 1975 “pretreatment” group was statistically similar, or perhaps slightly superior with regard to intelligence and achievement in mathematics, and since there had been no obvious demographic or social changes during the period 1974-76, the new mathematics program remained a plausible explanation for any changes in mathematics achievement from 1975 to 1976.

Pretest-posttest differences were subjected to a nested analysis of variance, with Region and School-within-region as factors and pupils within schools as the unit of analysis. The results appear in Table 1. The mean scores (Table 2) confirm that students who attended grade 6 after adoption of the core program scored significantly higher on the special tests than students in grade 6 the previous year.

TABLE 1
ANALYSIS OF VARIANCES FOR THE NESTED DESIGN
COMPARING STUDENT ACHIEVEMENT SCORES BEFORE
AND AFTER IMPLEMENTATION OF THE CORE PROGRAM ^a

Source of Variation	SS	df	MS	F	
Program	10812.18	1	10812.87	11.01	S
Region	10043.56	2	5021.78	5.11	S
School (Region) ^d	52050.12	53	982.97	3.08	S
Program x Region	393.18	2	196.90	0.61	NS
Program x Schools (Region) ^c	16890.56	53	318.69	4.88	S
Error ^b	459954.75	7047	65.70		

^a Achievement scores before implementation of Core Program, "Program I", and after implementation of Core Program, "Program II."

^b Error term for Program x Schools (Region), taking schools as random with Region and Program as fixed.

^c Error term for Program x Region and School (Region).

^d Error term for Program and Region.

Given the large number of schools (61), the significant Program x School interaction could not be readily explained. There was no significant interaction effect between program and region, indicating that program changes had relatively the same effect for all three regions, but the significant School x Program interaction indicated non-chance differences in achievement gains from school to school.

Cholvat (1974) provided the initial clue and a direction for the investigation. His findings indicated that teachers perceived the principal to be the key person for successful translation of the new program into classroom practice. The large number and relatively homogeneous nature of the county's schools discouraged search for an explanation in terms of socioeconomic differences among schools.

TABLE 2

SCHOOL MEANS AND STANDARD DEVIATIONS BY COHORT
FOR SCORES ON THE TEST OF MATHEMATICS ACHIEVEMENT
DESIGNED TO BE SENSITIVE TO OUTCOMES
OF THE NEW CORE CURRICULUM

Individual Schools	Cohort 1 1975 (Pretest)		Cohort 2 1976 (Posttest)		Individual Schools	Cohort 1 1975 (Pretest)		Cohort 2 1976 (Posttest)	
	Mean	S.D.	Mean	S.D.		Mean	S.D.	Mean	S.D.
1	35.79	6.16	35.76	11.45	32	34.69	6.32	34.49	8.15
2	27.98	7.90	30.03	7.19	33	35.32	7.39	40.88	5.90
3	33.53	7.88	39.77	5.79	34	25.81	7.48	36.00	9.22
4	31.29	7.96	31.63	9.67	35	34.05	6.74	38.49	8.02
5	38.02	7.55	37.60	8.09	36	33.45	7.57	30.90	8.10
6	32.40	7.73	34.17	7.04	37	32.72	9.18	32.40	8.67
7	29.04	7.85	39.31	5.86	38	31.57	6.44	28.21	5.37
8	28.74	7.29	32.72	8.86	39	30.69	8.15	32.86	8.19
9	32.22	6.75	32.22	7.06	40	31.54	8.29	36.40	7.64
10	29.83	9.98	28.49	8.17	41	37.32	7.74	39.11	5.79
11	32.14	8.34	37.21	7.47	42	33.55	7.27	36.64	7.96
12	31.33	8.25	32.53	8.20	43	35.52	9.13	36.42	6.81
13	33.81	7.04	35.71	7.54	44	32.31	7.55	42.13	6.83
14	32.03	7.05	36.71	6.19	45	29.55	8.89	31.59	8.96
15	40.62	5.47	38.47	8.46	46	28.64	8.42	37.33	6.70
16	32.09	8.54	30.29	8.80	47	28.79	7.85	29.40	7.32
17	26.94	6.34	34.17	6.18	48	27.97	6.71	28.68	8.12
18	35.31	8.04	37.88	6.48	49	29.83	7.58	38.56	6.35
19	31.82	7.11	33.28	4.84	50	21.36	7.80	29.08	8.56
20	34.69	7.85	37.15	7.90	51	34.35	8.18	32.56	6.63
21	30.19	7.67	28.43	7.86	52	29.70	7.70	31.45	9.43
22	32.68	8.27	33.13	8.31	53	25.66	8.66	32.55	9.29
23	33.18	6.88	39.67	6.94	54	26.51	7.39	28.65	7.13
24	34.41	7.80	35.79	6.41	55	30.44	7.40	34.41	8.95
25	35.57	6.50	38.08	7.36	56	24.47	9.02	30.64	7.31
26	35.90	7.83	34.53	6.87	57	30.48	6.35	35.58	7.21
27	31.42	7.27	39.69	7.61	58	33.85	8.08	35.33	8.02
28	34.75	7.88	37.06	7.66	59	23.77	6.40	28.14	7.48
29	33.85	7.79	33.50	8.15	60	32.34	8.34	32.00	9.74
30	32.34	8.47	34.70	7.65	61	32.29	7.87	33.56	7.23
31	35.32	10.67	38.21	7.89	Schools Combined				
						31.86	8.46	35.96	8.91

Search of the Literature

The idea that the success of new programs might be linked to strong leadership is not exactly new. Nachtigal (1972) suggested that the most successful adoptions (of new programs) occurred where the director was present and supportive throughout the planning to adaptation phases. Frey (1979) observed that a new program is more likely to survive if someone feels responsible for it, and Mahan (1972) identified the principal as the key to successful adoption of new programs. “Teachers teach more of a new curriculum in schools where the principal played an active role in learning about the curriculum” (Mahan, 1972, p. 153). McNeil supported this claim by indicating that “new curricula do not flourish when the principal remains in his office, verbalizes support, and lets the teacher struggle with the problems” (McNeil, 1977, p. 129).

Follow-up Procedure

Instrumentation was developed to gather data regarding the degree to which principals and consultants were actively involved in the implementation phase within the schools. A semantic differential ten-point rating scale was used, a score of 1 signifying that the principal was not active in the process and a score of 10

that he or she was totally active and supportive throughout 1975-1976. All grade 6 teachers were questioned individually by one of the consultants. Teachers were asked to respond to three questions relative to the 10-point scale: To what degree did you feel that your principal (i) participated in implementation meetings and was actively involved in the discussions and activities, (ii) was accessible and willing to listen to concerns and participate in program planning with individuals or in groups, and (iii) gave support to and acted on your concerns?

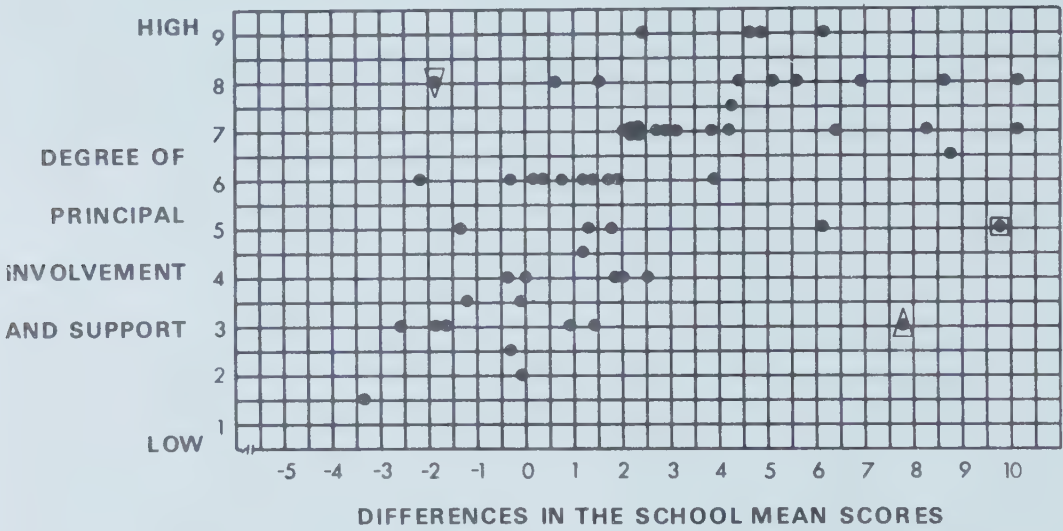


Figure 1. Differences in school mean scores ($\bar{X}_{1976} - \bar{X}_{1975}$) plotted against perceived principal involvement and support.

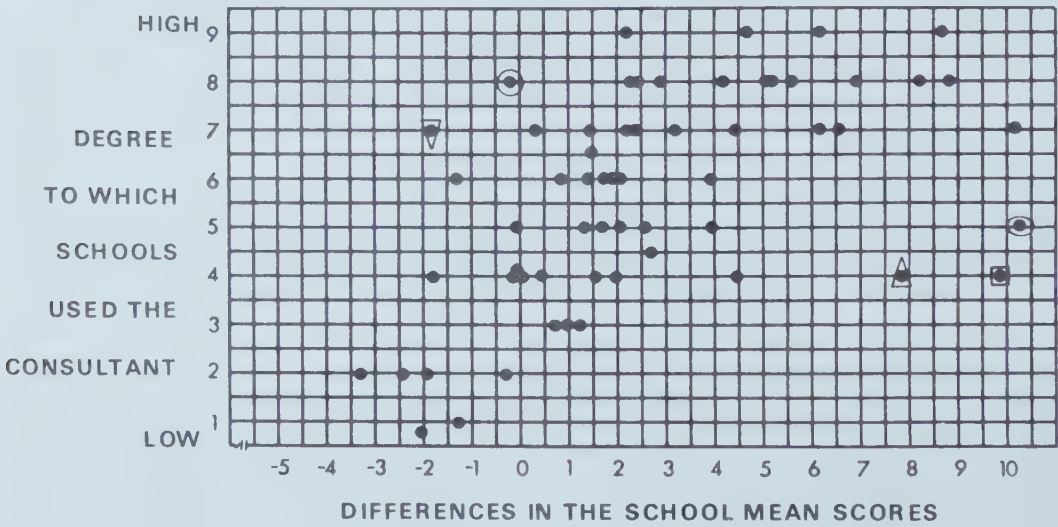


Figure 2. Differences in school mean scores ($\bar{X}_{1976} - \bar{X}_{1975}$) plotted against the degree to which schools made use of the consultant.

The median of the combined scores was obtained for each school. A standardization of these scores was required. This was provided by the consultants who produced a rating based on a more global perspective. Individually, they

rated each principal with respect to perceived participation at implementation meetings and the degree to which the principal acted on teachers' concerns. The final rating score was an average of the median score and the consultants' scores.

Consultants' records of visits to schools provided data on frequency of use of consultants.

Figure 1 is a plot of each school's mean score difference ($\bar{X}_{\text{posttest}} - \bar{X}_{\text{pretest}}$) against the rating assigned to the principal. Figure 2 is a plot of the same mean score difference against the frequency that a school employed the services of a consultant (also converted to a 10-point scale).

A correlation of 0.49 was obtained for the full set of data in Figure 1 and 0.53 for Figure 2 ($p < .01$) in both cases. If one removes the extreme values identified by the geometric shapes enclosing the points in question, the correlations increase to 0.64 and 0.77 respectively. The extreme values are themselves of interest, as seen below.

Summary and Discussion

The analysis presented in the tables and figures supports the notion that the more the principal was actively involved in the implementation process of a new program in the school, the better the students performed on the new test (note that in some schools, cohort 2 scored lower than cohort 1). The significant interaction signals the presence of unequal gains among schools and the figures give structure and meaning to the unevenness.

There is also a plausible link between Principal involvement and use of consultants, the similarity of Figures 1 and 2 are consistent with such a link. An active principal may be the one to involve the consultants and an inactive one to discourage it. Identification of schools on the fringes of both scattergrams revealed that they were the same schools. Additional investigation revealed that the school marked by the inverted triangle (low achievement, high initiative, and use of consultants) has a history of low achievers. The staff of the school indicated that the students attending the school were generally from a community where the socioeconomic level was low and that a large segment of these students would be new to the school, arriving from K-5 feeder schools. It seems unlikely, but perhaps there were more powerful forces operating in this one school than could be overcome by either the principal's initiative or curriculum implementation.

The school marked by the standard triangle (high achievement, low initiative, and use of consultants) was headed by a principal who was to retire at the end of the school year. According to consultants, the principal gave an enthusiastic staff considerable latitude in the development and implementation of school programs. The school indicated by the rectangle was also reported to be staffed by a group of especially enthusiastic teachers. One of the staff members had a good academic background in mathematics and was enthusiastic about teaching mathematics. She provided excellent leadership that might have been sought from consultants. The principal also gave this staff considerable latitude in developing and implementing programs in the school. These data suggest that leadership in implementation is essential. It frequently comes from the principal but may also come from others.

Cost conscious administrators may tend to downplay teacher needs. In times of economic austerity, curriculum planners must also consider that there are "diminishing returns" in learning opportunities. That is, there is a level of educational attainment beneath which dollars invested show a return in student

progress (McNeil, 1977). The point at which "diminishing returns" is reached may be viewed differently by administrators than by teachers. Principals who closely monitor the progress of the new programs are in a better position to recognize and respond when resources or support are needed (and thus earn a high rating). This notion is supported by Frey when he states, "Too often programs die because consumable materials are not replaced or broken equipment is not repaired. Someone must assume responsibility for knowing what materials need to be replaced" (1979, p. 209). Loucks puts this responsibility squarely on the shoulders of the principal,

Our research indicates that what the principal does is critical to success of an implementation effort . . . makes sure equipment and time are available for the new program, provides moral support, legitimizes early failures when they occur. Where this is true, teachers have resolved management concerns; where this kind of support does not come from the principal (who would be rated low), management concerns often run high. (Loucks, 1979, p. 215)

Researchers have argued that innovations should not start from goals perceived from outside the school. Instead, innovations should take each school where it is and use its strengths in fostering disequilibrium, alternatives, raising philosophical questions, and helping in evaluation (McNeil, 1977). Principals who assume a strong leadership position and are concerned with providing students with programs that will enable them to develop their fullest potential would seem to be in the most influential position to effect the activities that McNeil suggests. Where the teacher may perceive needs that reflect classroom concerns, the principal has the advantage of aligning these needs in a global sense with the school community as the unit. The data discussed in this paper provide empirical support for the often argued notion that the principal is a key factor in initiating and bringing about school change.

References

- Berman, P., McLaughlin, M. W., et al. *Factors affecting implementation and continuation*. Federal Programs Supporting Educational Changes, Vol. VII, Rand Corp., Santa Monica, 1977, ERIC ED 140 432.
- Cholvat, J. *Every teacher's survey*. Report to the Halton Board of Education, 1974.
- Frey, W. P. How to keep those new programs alive and well. *Educational Leadership*, 1979, 37(3), 208-210.
- Fullan, M., & Pomfret, A. Research on curriculum and instruction implementation. *Review of Educational Research*, 1977, 47(2), 335-397.
- Harms, T. Change agents in curriculum. *Young Children*, 1974, 29, July.
- House, E. R. Technology versus craft: A ten year perspective on innovation. *Journal of Curriculum Studies*, 1979, 11(1), January-March, 1-15.
- Hull, R. A research development and adoption model. *Educational Administration Quarterly*, 1974, 10(3), 33-45.
- Loukes, S., & Pratt, H. A concerns-based approach to curriculum change. *Educational Leadership*, 1979, 37(3), 212-215.

- Mahan, J. M. Frank observations on innovation in elementary schools. *Interchange*, 1972, 3(2-3), 144-160.
- Mann, D. (Ed.). *Making changes happen?* Teachers College Press, Columbia University, 1978.
- McNeil, J. D. *Curriculum: A comprehensive introduction*. Boston: Little, Brown, and Company, 1977.
- Nachtigal, P. A foundation goes to school. In J. D. McNeil, *Curriculum: A comprehensive introduction*. New York: Ford Foundation, 1972.
- Patterson, J. L., & Czajkowski, T. J. Implementation: Neglected phase in curriculum change. *Educational Leadership*, December, 1979, 204-202.
- Pravica, S. *Effects of implementing a year 6 core mathematics program as revealed in student achievement scores*. Ed. D. Qualifying Research Paper, O.I.S.E., 1977.
- Shiman, D. A., & Lieberman, A. A non-model for school change. *The Educational Forum*, 1974, 38(4).

PERSPECTIVES

Sex Differences in Performance On Raven's Progressive Matrices: A Review

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Raven's Progressive Matrices (RPM) has become one of the most widely used measures of intellectual ability, being recognised as perhaps the best measure of "g" and being readily adaptable to situations where language, culture, or physical handicap exclude the use of other measures (Kline, 1979). Three forms have been developed — at the lower level of ability the Colored Progressive Matrices (CPM) was developed for use with children, the elderly, and the intellectually handicapped (Raven, 1947). For testing within the normal adult range of ability, the Standard Progressive Matrices (SPM) (Raven, 1939) is appropriate, while for high-level selection, the Advanced Progressive Matrices (APM) has been developed as a timed test (Raven, 1963). All three tests were designed to be used in parallel with a vocabulary scale, the Mill Hill Vocabulary Scale (MHV), in order to give measures of nonverbal and verbal ability when required (Raven, Court & Raven, 1977).

The original norms for Raven's Progressive Matrices (RPM) were based on the assumption that there are no significant sex differences in performance (Raven, 1939). Neither the theoretical basis nor the standardization procedures of the RPM could provide unequivocal evidence to the contrary, but evidence from studies spread over 40 years is now available.

Spearman's (1923) statements regarding sex differences are inconclusive and contradictory. He claimed that there is no evidence for a superior level of the innate "g" factor in either of the sexes, yet on tasks of general ability males are

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superior to females on tasks involving education of spatial relations and correlates and male performance is more variable than that of females (Spearman, 1932).

Raven (1939, 1948) similarly placed little importance on the question of sex differences in RPM performance. On the basis of results obtained in SPM standardization procedures he did not consider it necessary to prepare separate norms for males and females. He stated:

There was no significant difference, either in the mean scores or the variance of scores, between boys and girls up to the age of 14 years. There were insufficient data to investigate sex differences in ability above the age of 14. (Raven, 1939, p. 30)

In a later article concerning the same subjects, a similar comment is made: "There were no consistent differences between the test scores obtained by boys and girls" (Raven, 1948, p. 14). In this latter article it is shown that there were no significant differences between male and female university students, but sampling problems made it difficult to test the possibility of sex differences in the population over 25 years of age.

While the original research studies indicate that sex differences are not important with RPM, the subject has received a great deal more attention in recent years. As studies have accumulated dealing with varying ages, levels of ability, and ethnic and social backgrounds, conflicting evidence has come forward on the importance of sex differences.

Many published studies which allude to sex differences are inconclusive since they have only examined such differences as a matter peripheral to other concerns. As a result, careful sampling cannot be assumed. Some studies claiming to report positive results are based on numerically small and inadequate samples, and a number, while claiming to find effects, fail to indicate whether the results reach acceptable levels of statistical significance.

Since the various forms of RPM were developed for rather different purposes, one may hypothesise that findings with CPM could well be different from those using either SPM or APM. Even though all three series rely on the sample principles for their solution, the levels of operation are very different. Different age-groups, cultures, and parts of the intellectual spectrum are involved. As the evidence below indicates, such factors do bear on RPM performance. Hence the most convenient way to approach the results is to examine CPM, SPM, and APM separately.

1. Studies with Standard Progressive Matrices (SPM)

Table 1 summarizes those studies which have used the SPM and found some sort of sex differences in performance, whether it be in favour of males or females on means or variability. Table 2 summarizes those studies which have utilized the SPM and discovered no sex differences.

There are various technical difficulties associated with these studies which must be identified before conclusions can be drawn from them.

Over half of the studies presented in Table 1 did not include tests of statistical significance for the sex difference results obtained. Some studies reported finding evidence of sex differences in discussion of results, but did not report data or comment on statistical significance. Other studies provided results with scores for both sexes and made no further comment on the significance of the differences

TABLE 1

SPM: SEX DIFFERENCES

	Name	Date	Country	Subjects	Results
1	Eysenck*	1943	Britain	Adult, Neurotic	Females superior to males on SPM Means-results statistically significant
2	Himmelweit	1946	Britain	Adult, Neurotic Service people	Females superior to males on SPM Means. Females also showed higher variability on SPM Scores. Female M - 40.65 SD - 8.25 Male M - 36.36 SD - 7.48
3	Rimoldi*	1947	Argentina	Children, 9-15 years	Males superior to females on SPM Means, only in older age groups. ($p < .01$)
4	Orton & Martin	1948	Britain	Prospective Medical Students	20 min. Timed version of SPM differences not tested for statistical significance. Female M - 50 SD - 3.0 Male M - 49 SD - 4.6
5	Johnson*	1952	U.S.	Retarded children 9.6 - 16 yrs.	Males superior to females on SPM Means. Females showed more variability than males. Higher individual variability for males than females. Results statistically significant.
6	Lingwood	1952	Britain	Shop assistants and Clerical workers 20-29 years	No sex differences on SPM Means in either group. Shop assistant males showed higher variability than females.
7	Arblaster & Jessop	1957	Britain	T.B. Patients	Sex differences in numbers of patients above and below SPM Medians, in minimum and extensive disease patients.
8	Morgan	1957	Wales	301 boys, 347 girls aged 10-12 yrs. varying degrees of bilingualism	Females slightly superior to males in most bilingual categories, but mean differences insufficient to justify separate consideration.
9	Valentine	1959	Iran	Secondary school students	Males superior to females on SPM Means.
10	Young et al.	1962	Italy	Children, 6th-8th grade	City children: males superior to females in SPM Mean Scores. Country children: females superior to males in SPM Mean Scores.
11	Foulds & Dixon*	1962	Britain	Schizophrenics & Neurotics	In both diagnostic groups males superior to females on SPM Mean Scores. Differences statistically significant.
12	Foulds et al.*	1962	Britain	Schizophrenics	Males, in all diagnostic groups superior to females on SPM Means. Differences statistically significant.
13	McLeod & Rubin	1962	Canada	Neurotics	Mean and variability Scores for males greater than for females.
14	King*	1963	Britain	Children, 5.25-17.33 yrs.	Significant sex difference in favour of females on SPM Means for total subject group.
15	Siegel	1963	U.S.	Children, 9-18 years	Sex differences in types of errors made on SPM
16	MacArthur, Irvine & Brimble*	1964	Rhodesia	Standard 6 & Form II students	Males superior to females in Standard 6 ($p < .05$). No difference with Form II. No difference on variability.
17	Sitkei & Michael	1966	U.S.	Subjects, 16-49 years	Males slightly superior to females on SPM Means. Male X - 37.5 Female X - 35.6
18	Bruni	1966	Italy	Secondary school students	Technical schools: Males superior to females on SPM Means. Females more variable than males.
19	Heron & Chown*	1967	Britain	Adults	Normative study. Males superior to females ($p < .01$) on timed SPM. Differences less with older groups.
20	Klingelhofer*	1967	Tanzania	Secondary School students	African students: No sex differences, except in Form 3 where females superior on SPM Means. Asian students: Males superior on SPM Means in Form 2, and for all forms combined. Differences statistically significant.

TABLE 1 (continued)

Name	Date	Country	Subjects	Results																													
21	Sydiaha	1967	Canada	Adult Psychiatric patients	No significant sex differences in SPM Mean Scores. Variability Scores as follows: Male SD - 11.1 Female SD - 9.6																												
22	Sinha	1968	India	Children 12-14 years & University students	<table><thead><tr><th></th><th colspan="3">Males</th><th colspan="3">Females</th></tr><tr><th></th><th>12 yrs.</th><th>13 yrs.</th><th>14 yrs.</th><th>12 yrs.</th><th>13 yrs.</th><th>14 yrs.</th></tr></thead><tbody><tr><td>Rural</td><td>22.50</td><td>26.50</td><td>27.10</td><td>-</td><td>36.83</td><td>30.00</td></tr><tr><td>Urban</td><td>24.00</td><td>27.40</td><td>29.10</td><td>25.50</td><td>28.90</td><td>30.10</td></tr></tbody></table> Females slightly superior to males in all groups on SPM Means.		Males			Females				12 yrs.	13 yrs.	14 yrs.	12 yrs.	13 yrs.	14 yrs.	Rural	22.50	26.50	27.10	-	36.83	30.00	Urban	24.00	27.40	29.10	25.50	28.90	30.10
	Males			Females																													
	12 yrs.	13 yrs.	14 yrs.	12 yrs.	13 yrs.	14 yrs.																											
Rural	22.50	26.50	27.10	-	36.83	30.00																											
Urban	24.00	27.40	29.10	25.50	28.90	30.10																											
23	Vejleskov*	1968	Denmark	Grade 5 children	Males work faster than females on SPM. Female performance superior, especially on Set D, for one school of two ($p<.05$).																												
24	Wiltshire & Gray	1969	Canada	Reserve Indians 7-15 years	No significant sex differences on SPM Mean Scores. Females showed significantly higher variability than males.																												
25	Foulds*	1970	Britain	Psychiatric Adults	7 out of 8 worst groups tested on SPM were female. 4 best groups were male. Differences statistically significant. No sex differences in time taken to complete test.																												
26	Georgas	1970	Greece	Children, 6-12 years	Males superior to females on SPM Means in 10, 11, and 12 year old age groups.																												
27	Kear-Colwell	1970	Britain	Psychiatric Adults	Males superior to females on SPM Means. Male X - 44.8 Female X - 41.6																												
28	Stachyra	1971	Poland	40 deaf, 40 controls aged 14, half of each sex	Males superior to females.																												
29	Mohan*	1972	India	College & University students	Males superior to females on SPM Means Male X - 46.48 Female X - 43.88 ($p<.01$)																												
30	Mohan & Kumar	1973	India	100 students aged 18-25 yrs.	Males superior to females.																												
31	Valseschini & Delton	1973	Italy	Subjects 11-60 years	Males superior to females Male 50th centile = 36 points Female " " = 30 points																												
32	Baraheni	1974	Iran	2355 girls, 3206 boys, aged 9-18 yrs.	Boys superior to girls up to age 13 and at age 16.																												
33	Szegedi	1974	Hungary	300 Budapest inhabitants, aged 15-60 yrs.	Differences between sexes found but "merely accidental" and unsystematic.																												
34	Rao*	1975	India	1025 boys, 1019 girls, aged 15-18 yrs.	Males superior to females and with higher variability except at age 17. An age x sex interaction reported.																												
35	Mohan & Bhanot	1976	India	60 children	Males superior to females on subsets and total scores.																												
36	Nathan & Schnabl*	1976	Israel	776 kibbutz-born children, aged 11-18 yrs.	Males superior to females at ages 15-18. Females superior at ages 11-13. No difference at age 14.																												
37	Vandenberg & Price	1978	U.S.	167 males, 210 females, ages <20 to 60+	A gender rather than a sex difference: subjects scoring high on masculinity also scored higher on SPM even with sex partialled out.																												

* Sex difference results tested for statistical significance.

between these scores. Only those studies marked with an asterisk actually tested the differences for statistical significance. Had many of the non-asterisk studies been subjected to tests of statistical significance, they would probably have concluded that no significant sex differences existed in the sample investigated.

TABLE 2

SPM: NO SEX DIFFERENCES

	Author	Date	Country	Type of Subjects
1	Raven	1939	Britain	Children to 14 years and University students
2	Rimoldi	1945	Argentina	Children 7-14 years
3	Chauffard	1949	France	Children 9-14 years, from two socioeconomic status levels
4	Levine & Iscoe	1954	U.S.	Undergraduates: Mean age 19 years 1 month
5	Crawford	1955	Britain	Children, 7 yrs. 5 months to 10 years
6	Levine & Iscoe	1955	U.S.	Deaf students, 15-19 years
7	Elley & MacArthur	1962	Canada	Grades 6 & 7 children
8	Arian et al.	1962	Italy	Psychiatric patients, 65-80 years
9	Tesi & Young	1962	Italy	3432 students, 10½-16½ yrs., a 4% population sample
10	MacArthur	1965	Canada	White, Indian and Eskimo students. A normative study, 10-14 yrs.
11	Montgomery	1966	Britain	Grade 3 Deaf children - 20 min. Timed version of SPM used
12	Wetherick	1967	Britain	University students
13	Tulkin & Newbrough	1968	U.S.	Negro & White children, 5th and 6th grade
14	Di Fiore & Renda	1969	France	Apprentices and college students
15	MacArthur	1969	Canada	Eskimo, White and Indian children, 9-12 years
16	Brandis & Henderson	1970		Over 600 subjects
17	Petersen	1971	Australia	Secondary School students, 14-17 years
18	Langevin	1971	Canada	269 6th graders; mean age 11 years 8 months
19	Bartlett, Newbrough & Tulkin	1972	U.S.	356 5th graders
20	Kennedy	1972	Australia	159 secondary school students, aged 14-16 years
21	Alonso	1973	Cuba	A normative study with school and preuniversity students, aged 6-12 years
22	Byrt & Gill	1973	Eire	3464 Primary School children, aged 6-12 years.
23	Chang	1975		100 4th graders and 80 6th graders. Boys better on reasoning tasks and this correlated with SPM, but no sex difference per se reported.
24	Simon & Ward	1975	Wales	60 11-12 yr. olds and 60 14-15 yr. olds, equally male and female in a study of relationships of age, sex, intelligence and religious beliefs.
25	Chang	1976		284 4-6th graders, half taught by a male, half by a female
26	Gill	1976	Eire	3500 children, 6-12 yrs. No combination of predictors, including sex, could explain more than 7% of SPM variance
27	Mohan & Kumar	1976	India	100 students aged 18-25 years
28	Sweet	1976	Australia	Normative study of 1000 adolescents
29	Ghuman	1977	Wales	60 11-12 year olds, middle and working class. Apparently no significant differences found.
30	Kanekar	1977	India	71 male, 101 female undergraduates
31	Marjoribanks	1978	Australia	240 girls, 260 boys, 6th grade from 15 elementary schools, aged 10.8-11.5
32	Surrey Educational Authority	1978	Britain	11,621 12 year olds
33	Conrad	1979	Britain	254 males, 246 females, deaf school leavers. No difference between sexes or for a sex x hearing loss interaction
34	Mohan & Kumar	1979	India	400 students aged 19-25 years
35	Raven	1981	Britain	Standardisation sample, aged 6-15; 1668 boys; 1591 girls. Brief advantage for girls at age 11 to 11½.

A second technical problem concerning the research listed in Tables 1 and 2 relates to experimental flaws. Sample bias favouring one sex may have generated the sex difference results obtained; in other studies there are signs of important interactions with variables such as age, social class, and cultural norms. Nine of the studies in Table 2, which found no sex differences, were on populations of high secondary or tertiary students (Raven, 1939; Levine & Iscoe, 1954; Wetherick,

1967; Di Fiore & Renda, 1969; Petersen, 1971; Alonso, 1973; Mohan & Kumar 1976; Kanekar, 1977; Mohan & Kumar, 1979). Assuming that selection procedures for these populations were, at the time of the studies, based in favour of "bright" girls, the generality of the results obtained is in doubt.

Heron and Chown's (1967) data appear to demonstrate sex differences favouring males, but the observed differences are qualified in several ways by the authors. Their view is that "lack of use of abstract problem solving ability speeds its deterioration," and this effect would apply more to women than men, and is consistent with the finding that scores for men dropped off more in the 60-70 age range than for women. Their data were also derived using a timed version of SPM (20 minutes and 40 minutes). Under these circumstances males may be favoured (Vejleskov, 1968). SPM should be administered untimed, and an optimum score is not obtained under timed conditions (Kundu & Sen, 1964).

Rao (1975) examined 15- to 18-year-old students in various types of schools in India. It is consistent with the observation of many that sex role differentiation is firmly established in Indian education, that boys performed better than girls at all the ages tested, except age 17. With educational standard held constant, the difference favouring boys increased with increasing age. Variability of score among boys was also larger.

The importance of sex differentiated educational experiences is noted in another Indian study, that of Mohan and Bhanot (1976). They point to the mathematical nature of the problem-solving task posed by SPM, find a positive correlation between SPM and a mathematical test, and remark that "mathematical and problem-solving situations are essentially associated with masculine role . . . the Indian educational system promotes the growth of certain attitudes which lay emphasis on Algebra and Geometry as being masculine subjects." Their finding of a positive advantage for males has also been reported with other samples by Mohan (1972) and Mohan & Kumar (1973), but not in their more recent studies (Mohan & Kumar, 1976, 1979).

Expectations about the distinctive ways in which the sexes are reared also lie behind positive results from Israel. Nathan and Schnabl (1976) gave SPM to children of different ages being reared in various types of kibbutz. The results were complicated in that girls proved superior at ages 11-13, while boys were superior at ages 15-18, and no difference was found at age 14. The authors express the view that certain types of kibbutz environment favour boys, while others favour girls. They also note that in another Israeli study by Guttman (1974) with a non-kibbutz sample, boys performed consistently higher than girls on SPM.

A further consideration of reasons for positive findings comes from Ziv (1972), who examined the possibility that differences might arise from differentiated reinforcement contingencies for the two sexes. While this did not emerge, they did find a significant interaction between the sex of examiner and examinee. In studying 120 boys and 120 girls examined in Israel by either a man or a woman, Ziv found:

The man influenced the boys more: the woman had greater influence on the girls. In spite of the man's greater prestige in society as a whole in intersex interaction girls reacted more positively in the woman's presence than in the man's. (p. 117)

The most remarkable aspect of the research summarized in Tables 1 and 2, keeping in mind the technical problems described, is the lack of consistency in favour of either sex and the lack of consistency in the type of results obtained in similar populations. This would lead one to be doubtful of the differences and to look for interpretations in terms of interactions with other variables.

Seven studies in Table 1 report evidence of superior mean scores for females (Eysenck, 1943; Himmelweit, 1946; Morgan, 1957; King, 1963; Sinha, 1968; Vejleskov, 1968; Nathan & Schnabl, 1976). Both Eysenck (1943) and Himmelweit (1946) acknowledge that their sex difference in favour of women in neurotic populations was probably due to the biased selection procedures in favour of "bright" women in the British Armed Forces. King (1963) attributes his finding to the lack of a representative sample. Morgan (1957) considered the observed differences too small to warrant consideration. Vejleskov (1968) obtained significance only for one of two groups of school children who were differentiated mainly by social class, while Sinha's (1968) results are marginal and not tested for significance. Nathan and Schnabl (1976) found the superiority only at ages 11-13, perhaps related to the earlier physical maturity of the female (Tesi & Young, 1962). There is therefore not sufficient evidence here to make a case for a sex difference favouring females.

Of the 37 studies in Table 1 indicating some kind of sex differences, 15 report a difference in means favouring males in relation to all subjects tested, while a further eight studies found such differences in some groups but not others. Of the 15 studies only seven also report tests of statistical significance (Johnson, 1952; Foulds & Dixon, 1962; Foulds, Dixon, McClelland & McClelland, 1962; Heron & Chown, 1967; Mohan, 1972; Mohan & Kumar, 1973; Mohan & Bhanot, 1973). The studies by Johnson and by Foulds deal with clinical populations with no control over sample bias; the Heron and Chown results have been considered above. Mohan's reports provide the most consistent series of studies identifying clear sex differences among Indian students.

With variance, the studies divide rather evenly for the sexes with no convincing evidence for this being greater for either sex.

The discrepancy of sex difference results across similar populations is illustrated well by those studies using psychiatric patients. Six research reports have published evidence of male superiority on SPM means, or increased male variability in psychiatric patient samples (Foulds & Dixon, 1962; Foulds et al., 1962; McLeod & Rubin, 1962; Sydiaha, 1967; Foulds, 1970; Kear-Colwell, 1970). However, Arian, Delogu, Scazella and Zanalda, (1962) report no evidence of sex differences in a group of adult psychiatric patients. The large numbers of British and U.S. studies in both the sex difference and non-sex difference tables also illustrate the discrepant nature of sex difference results. Trends in such studies which appear to favour males may well arise from sample bias in psychiatric populations.

There is a very slight trend for poor or non-Western culture studies to appear in the sex difference table. Sex differences in SPM performance have been found in Argentina (Rimoldi, 1947), Iran (Valentine, 1959; Baraheni, 1974), Italy (Bruni, 1966; Valseschini & Delton, 1973), Tanzanian Asians (Klingelhofer, 1967), India (Sinha, 1968; Mohan, 1972; Mohan & Kumar, 1973; Rao, 1975; Mohan & Bhanot, 1976), Greece (Georgas, 1970) and with American Indians (Wiltshire & Gray, 1969). Young, Tagiuri, Tesi, and Montemagni, (1962) reported sex differences in

an Italian study but a further report of the same study (Tesi & Young, 1962) shows that the differences were not statistically significant. Tesi and Young in fact tentatively offer an explanation of sex differences at the time of the adolescent growth spurt which might account for girls performing better than boys for a year or two. While their data appear to indicate such a possibility, the failure to demonstrate such a differentiation at a statistically acceptable level weakens the case. Raven (1981) found a significant difference favouring girls at age 11 to 11½ only.

Most of these studies do not give statistical evidence on the differences reported. Where they do, they typically find differences in some groups but not others, suggesting that interactions with age and educational opportunity may be more important than any sex differences per se. MacArthur's extended range of studies in Africa and North America led him to conclude in 1969 that, while differential upbringing can result in differences in some abilities including performance on SPM, this is not always so. Evidence in further support of this comes from Mohan's Indian studies, and from Nathan and Schnabl in Israel.

Summarising work over many years and across several cultures, MacArthur (1978) is of the opinion that when sex differences are found, this arises from cultural expectations, such as the encouragement of spatial skills in males and verbal skills in females. Referring to studies of Eskimos and Nsenga Africans he notes:

One of the striking findings of this study was almost no sex differences in any of the ability tests for any of the age groups in any of the ethnic samples This sex non-differences finding strongly suggests that on this broad battery of cognitive tasks for these samples such sex-differences as do occur are not likely to be of biological origin, but related, rather, to circumstances in the upbringing of a particular age-group in a particular setting at a particular time. (p. 199)

Most studies cited here did not specifically seek to test for sex differences in any controlled manner, but simply reported results incidentally. Kennedy (1972) therefore undertook a study with the sex variable specifically in mind and concluded that neither means nor variability showed a difference. Similarly the detailed standardization study of Byrt and Gill (1973), which took care of control for social class, failed to find significant sex differences (see also Gill, 1976). In a restandardization study of SPM recently completed, Raven (1981) found sex differences again failed to appear, except briefly at age 11 to 11½.

An interesting aspect of sex differences in SPM performance is the possibility of differences in types of errors made by the sexes. Sigel (1963) analyzed the responses made to Items A7 and B7 of the SPM, by children aged 9 and 10 years. On Item A7 boys and girls differed, not in the number of errors made, but in the kinds of errors. Girls made more errors because of difficulty in perceptual discrimination and Sigel (1963) has suggested that girls at this age are more global in their approach to perceptual problems than boys. On Item B7 boys and girls made a similar error but selected different answers to exhibit it.

A Danish study used fifth grade children to show that girls perform in a fashion superior to boys on Set D (Vejeskov, 1968). Girls are also superior on the last part of Series B, but on Series B, Items 3 to 7, boys appear to be dominant. Richardson (1969) has come to similar conclusions but suggests the differences

may relate to personality patterns rather than sex per se (cf. Mohan & Kumar, 1973). Guttman (1974) has suggested a genetic basis for male superiority on E-8 which involves mental rotation.

These item analysis studies indicate that any investigation into sex differences should look not only at means and variability, but also at types of errors made. A detailed study on these lines has come from Bartlett, Newbrough and Tulkin (1972). They found differences between social class and racial groupings in the ways in which items were analyzed, but no such differences between sexes could be found.

In all the SPM evidence presented, there is no consistent difference in favour of either sex over all populations tested. Table 2, in listing 35 studies which report no difference, includes a number of large and detailed investigations with evidence coming from five continents. The most common finding is of no sex difference. Reports which suggest otherwise can be shown to have elements of bias in sampling, or include other variables which could covary with sex. Cultural factors are among the possible influences, but are most readily examined in relation to CPM studies.

2. *Studies with Colored Progressive Matrices (CPM)*¹

Norms for the CPM are based on the assumption that there are no significant differences in performance by either sex. The original norming sample of 608 Dumfries children aged 5-11½ years was relatively small, and from a limited geographical area. Raven (1939) reports, "There was no significant difference, either in the mean scores or the variance of scores, between boys and girls up to the age of 14 years."

More recently, MacArthur (1965) developed norms for 751 children in northwest Canada. He concluded that there was no significant difference for the overall sample aged 6½-9½ years, except for a significant difference, at the 0.05 level, favouring boys in the 8-9½ year age group. He wrote, "Analysis of variance indicated no significant differences, so that the boys and girls may be referred to the same set of norms."

Contrarily Rao and Reddy (1968) did not report significant differences when they developed norms from a sample of 1,017 elementary school children in India. Notwithstanding, they published norms separately for boys and girls, by age, for each year from 5 to 10 years inclusive, and by school grade.

Tables 3, 4 and 5 summarize studies which refer to differences in performance on the CPM by boys and girls. While 18 studies failed to find significant differences (Table 3), and a further 7 (Table 4) did not test for significance, there are 17 studies in Table 5 in which significant differences between sexes were found.

Comparison and analysis of the studies cited are, like those for SPM, complicated by several factors. Studies were typically more concerned with such issues as mental or physical handicap, socioeconomic status, or cultural differences, than sex differences per se. The results are therefore complex.

Table 3 presents the results of those 21 studies which found no differences between the sexes on CPM. They seem at first sight to present a fairly clear picture but, in reality, these findings too deserve caution. They cannot all be treated as comparable tests of the performance of CPM.

TABLE 3

CPM SEX DIFFERENCES NONSIGNIFICANT

	Author	Date	Country	N	Type of Subjects						
1	Norman & Midkiff	1955	U.S.A.	96	Navaho children, 9 yrs. 6 mths. to 13 yrs. 6 mths.						
2	Higgins & Sivers	1958	U.S.A.	789	Negro & White children, 7 yrs. to 9 yrs. 11 mths.						
3	Tuddenham et al.	1958	U.S.A.	124	Negro & White children, Grades 3-6.						
4	Harris	1959	U.S.A.	98	Kindergarten children. <table><tr><td>Male</td><td>Female</td></tr><tr><td>M - 16.24</td><td>M - 16.25</td></tr><tr><td>SD - 3.00</td><td>SD - 3.8</td></tr></table>	Male	Female	M - 16.24	M - 16.25	SD - 3.00	SD - 3.8
Male	Female										
M - 16.24	M - 16.25										
SD - 3.00	SD - 3.8										
5	Kuroda	1959	Japan	80	Children, 4-6 years						
6	Levinson	1960	U.S.A.	238	Kindergarten and Grade 1 children						
7	Malpass, Brown & Hake	1960	U.S.A.	104	Retarded & Normal children						
8	Rich & Anderson	1965	U.S.A.	115	Blind children, 6-15 years						
9	Payne	1967	U.K.	298	Children, West Indian and English						
10	Elkin	1968	Canada	59	Educable retardates, mean ages, 25 males and 34 females						
11	Rohwer, Ammon et al.	1971	U.S.A.	288	Children, Kindergarten, 1st and 3rd grade. Low SES Negro, High SES White						
12	Deshpande	1971	India	1534	Children, 8-11 years						
13	Milgram	1971	U.S.A.	80	Children aged 6-16 years						
14	Turner, Hall & Grimmett	1973	U.S.A.	96	Middle and lower class kindergarteners						
15	Garrity & Donaghue	1976	U.S.A.	22	Children 5 years old						
16	Kerr	1976	U.K.	256	Children, 5-9 years						
17	Kurdeck	1977	U.S.A.	96	First through fourth grade children						
18	Mills	1978	S. Austr.	233	Children, 9-11 years; 117 boys, 116 girls						
19	Molloy & Das	1979	Australia	120	Grade 4 children						
20	Myers & Goldstein	1979	U.S.A.	101	Aged 5-12, 40 monolingual, 53 Puerto Rican Spanish/ English speakers, all from poor families						
21	Panek & Stoner	1980	U.S.A.	150	Adults aged 20-86 years.						

In defining a psychological test as a “standardized measure,” Anastasi (1976) says “Standardization implies uniformity of procedure in administering and scoring a test. If the scores obtained by different individuals are to be comparable, testing conditions must obviously be the same for all.” She also stresses the importance of a trained examiner.

An adequate realization of the need to follow instructions precisely, as well as a thorough familiarity with the standard instructions, is required if the test scores obtained by different examiners are to be comparable, or if any one individual's score is to be evaluated in terms of the published norms. (p. 31)

Referring to machine-scorable answer sheets, Anastasi says that these cannot be assumed to be equivalent to those in standardization samples, in the absence of empirical verification.

In this context it should be noted that neither Levinson (1960) nor Harris (1959) record whether the Book or the Board Form was used. Kuroda (1959) in his study of 90 Kindergarten children found, nonsignificantly, that “the percentage of pass on the Board Form was generally higher than on the Book Form.”

In Table 4, a series of studies is presented in which authors indicate a sex difference though without providing statistical tests of the differences. The combined trend is towards male levels being superior to those for females. The studies include substantial samples across the age-range for the test, and are

drawn from a variety of populations and countries. Such consensus cannot be disregarded.

TABLE 4
CPM SEX DIFFERENCES: SIGNIFICANCE NOT TESTED

	Name	Date	Country	N	Subjects	Results
1	Bruni	1954	Italy	931	Children 8-11 years	Males in all age groups slightly superior to females on CPM Means. Except in age groups 9 and 11, males had higher variability.
2	Kilburn et al.	1966	U.S.A.	100	Mild Mental Retardates	Male M - 15.22 SD - 4.62 Female M - 14.52 SD - 4.36
3	Cantwell	1967	U.S.A.	727	Children, gr. 2 & 5, 2 SES levels	Males superior on CPM Means in both SES levels
4	Anderson Kern & Cook	1968	U.S.A.	147	Brain damaged subjects 16-65 years	Males superior on CPM Means, especially in low SES groups.
5	Rao & Reddy	1968	India	1017	Children 5-10 years	Developed separate norms for boys and girls. Male M = 15.78 SD = 6.62 Female M = 14.52 SD = 6.00
6	Sinha & Chandrakala	1972	India	50	Children 5-12 years	Male M = 17.2 SD = 7.92 (N=22) Female M = 19.1 SD = 6.55 (N=28)
7	Georgas & Georgas	1972	Greece	227	Children 6-12 years	Means M 9.40 9.98 11.15 14.31 18.55 23.52 26.05 F 10.04 10.78 12.07 14.30 16.73 19.13 20.18

In Table 5, the 17 studies finding clear differences support the case for males performing slightly but significantly better in a wide variety of contexts. Comparison of data coming from advanced and developing countries suggests that differences are greater among the latter. Where age differences are also apparent, the trend is towards greater equality in the upper ages (Muller, 1970; De & Kala, 1971) but even this hint of differential development is not supported by the German studies of Eggert (1969) or Winkelman (1972) where significance was not found at younger ages.

It is tempting to seek a single explanation for such differences as have been found, but such parsimony cannot be scientifically justified. Allowing that sex differences do reliably appear in some studies, they have failed to appear in other studies which appear to be at least as competent in their execution and relate to similar circumstances. Unlike the SPM results, the advantage is almost exclusively for males in these studies when it does appear. This raises questions of expectations, sex role stereotyping, and cultural differences in opportunity. Some support for such environmental variables emerges, as in those situations where diverse ethnic groups have been studied (Klippel, 1975; Rawlinson, 1974) but even results such as these deserve caution. Jensen (1971) in seeking those factors which can be identified as contributing to observed sex differences refers to the positive findings of Semler and Iscoe (1966) for blacks and whites in the U.S.A. He comments that "unfortunately because of the relatively small samples used by Semler and Iscoe, we cannot be very confident whether these are *test* differences or *sample* differences" (p. 136).

TABLE 5

CPM, SEX DIFFERENCES SIGNIFICANT

	Name	Date	Country	N	Subjects	Results																									
1	Sperrazzo & Wilkins	1958	U.S.	480	Negro & White children, 3 SES levels	No significant sex differences in CPM Means. Sex factor only significant in race x age x sex x status interaction.																									
2	Sperrazzo & Wilkins	1959	Canada	480	Negro & White children 3 SES levels	Males superior to females on CPM Means only in lowest socioeconomic status group ($p<.01$).																									
3	Klauer	1964	Germany		Children 6-11	Males superior to females except at 7 ⁰ and 9 ⁵ .																									
4	MacArthur	1965	Canada	751	Children 6.5-9.5 yrs.	Males superior to females on CPM Means ($p<.05$). Older groups using SPM: no significant sex differences.																									
5	Freyburg	1966	New Zealand	159	Children, 5 yrs. 9 mos.-7 yrs. 10 mos.	Males superior to females on CPM Means ($p<.01$).																									
6	Semler & Iscoe	1966	U.S.A.	275	Negro & White children, 7-9 years	Mean scores: <table><tr><td></td><td></td><td>7 yrs.</td><td>8 yrs.</td><td>9 yrs.</td></tr><tr><td>White</td><td>Males</td><td>15.83</td><td>25.20</td><td>21.42</td></tr><tr><td></td><td>Females</td><td>15.00</td><td>22.33</td><td>22.08</td></tr><tr><td>Negro</td><td>Males</td><td>9.42</td><td>21.85</td><td>21.75</td></tr><tr><td></td><td>Females</td><td>12.67</td><td>20.57</td><td>19.50</td></tr></table>			7 yrs.	8 yrs.	9 yrs.	White	Males	15.83	25.20	21.42		Females	15.00	22.33	22.08	Negro	Males	9.42	21.85	21.75		Females	12.67	20.57	19.50
		7 yrs.	8 yrs.	9 yrs.																											
White	Males	15.83	25.20	21.42																											
	Females	15.00	22.33	22.08																											
Negro	Males	9.42	21.85	21.75																											
	Females	12.67	20.57	19.50																											
7	Eggert	1969	Germany		Retarded children 7-12 yrs.	Males slightly superior overall but not at age 8.																									
8	Goetzinger & Houchins	1969	U.S.	80	Children, 6.5-8.5 yrs. Hearing and deaf.	Males superior to females on CPM Means in hearing group. No significant sex difference in deaf group.																									
9	Muller	1970	Germany		Children 6-11	Overall difference favouring males, but significant only at ages 8, 9, and 10 yrs.																									
10	Berry	1971	Cross-Cultures	496	Subsistence level, Native groups, 10-70 yrs.	Males superior to females on CPM Means, only in sample of 90 Temne Indians where sex role separations are strong.																									
11	De & Kala	1971	India	833	Children 7-12 yrs.	Males superior to females at age 7-8 yrs. Females superior to males at age 11-12 yrs. No significant difference at age 9-10 yrs.																									
12	Jensen	1971	U.S.	1007	Children 5.5-12.6, Black & White	Males superior to females, especially among Whites																									
13	Jensen	1971	U.S.	1236	Children 5.5-12.6, Mexican & White	Males superior to females, but great variability with age.																									
14	Winkelman	1972	Germany		Children aged 6-11	Small but significant superiority for males except at ages 5 and 7.																									
15	Rawlinson	1974	Papua-New Guinea & Tasmania	76	Equal nos. from each country, grades 3-6.	New Guinea, males superior to females ($p<.01$). Tasmanians: not significant.																									
16	Klippel	1975	New Zealand	60	Equal groups of Maoris, Samoans and Pakehas	Sex and ethnicity interaction ($p<.01$). Polynesian males superior to females. Reverse pattern for Pakehas (Europeans).																									
17	Andersson, Berg, Lawenius & Svanborg	1978	Sweden	181	70 year olds, (77 male, 104 female)	Normally distributed scores for both sexes, with males superior to females ($p<.05$)																									

Turning then to a large sample of Mexican-Americans compared with whites, a sex difference favouring males was again found, with larger differences for whites than blacks. Leading with the hypothesis that the magnitude of sex difference is a function of the degree of environmental deprivation experienced, Jensen has to conclude finally that “because of the considerable variability of the sex differences among various age groups, no strong interpretation can be made of the data” (1971, p. 136).

The significant results of Andersson, Berg, Lawenius and Svanborg (1978) deserve comment as they are derived from an elderly sample. In a study of urban

70-year-olds, a series of verbal, reasoning, and perceptual tests was given. CPM was discrepant in that it was the only test on which significant differences were obtained. In view of this, the authors have concluded that “the difference between men and women in Raven’s Coloured Progressive Matrices is difficult to explain and not in line with the results from other tests” (1978, p. 65).

The German version of the CPM manual carries a review of evidence relating to sex differences which leads one to equally cautious conclusions. After commenting about the heterogeneity of findings, the review concludes that even if there were a consistent difference in favour of boys, the difference is too small to be of practical significance (Schmidtke, Schaller & Becker, 1978).

For most practical purposes, then, it appears that sex differences on CPM can be disregarded. Under some not-well-defined conditions, sex differences can be expected and when these occur they are likely to favour males. Such differences may well be of research significance if identified factors can ultimately be isolated, but they do not justify the production of separate norms for the two sexes. A finding of significant sex differences does not of course necessarily invalidate test findings. Rather, it may well result from the sensitivity of the test to such variables as socio-economic status or ethnicity.

3. *Studies with Advanced Progressive Matrices (APM)*

Very little attention has been paid to sex differences with the APM. The situation can be conveniently summarized by saying that no reason to postulate sex differences at this level has been advanced. Wittenberg (1958) in studying a German random sample found a slight but nonsignificant bias towards males. Van Dam (1976), in a Belgian study of university undergraduates, also found a nonsignificant difference between the sexes.

Discussion

Where sex differences on RPM emerge they relate to other variables. There is support for the importance of cultural expectations for the sexes and for the interaction of examiner’s sex with that of the examinee.

At the lower levels of testing, it appears that different strategies may be used to come to correct solutions, with some subjects preferring spatial strategies while others verbalise (Corman & Budoff, 1974; Kirby & Das, 1978) whereas at higher levels more analogical reasoning is involved. Factorial studies (e.g. MacArthur, 1978; Das, Kirby & Jarman, 1979) make it clear that factor loadings for RPM performance vary quite substantially across cultures and that efficient strategies can be learnt.

The accumulated evidence at all ability levels indicates that a biological sex difference cannot be demonstrated for performance on RPM. Indeed, two genetic studies have specifically looked for the possibility of a linkage in spatial tasks, including a slightly modified SPM, and found no evidence for this (DeFries, Johnson, Kuse, McLearn, Polovina, Vandenberg & Wilson, 1979; Guttman & Shoham, 1979).

Notes

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References

- Alonso, O. S. Raven, factor "g", edad y escolaridad (Raven, "g" factor, age and school level). *Havana Hospital Psiquiatrico Revista*, 1973, 14, 60-77.
- Anastasi, A. *Psychological testing*. New York: MacMillan, 4th Edition, 1976.
- Anderson, H. E., Kern, F. E., & Cook, C. Sex, brain damage and race effects in the Progressive Matrices with retarded populations. *Journal of Social Psychology*, 1968, 76, 207-211.
- Anderson, E., Berg, S., Lawenius, M., & Svanborg, A. Intellectual functioning in a 70-year-old urban population. *Acta Psychiatrica Scandinavica*, 1978, 57, 59-66.
- Arblaster, P. G., & Jessop, M. Intelligence as a factor affecting the diagnosis of pulmonary tuberculosis. *British Journal of Tuberculosis and Diseases of the Chest*, 1957, 51, 358-366.
- Arian, E., Delogu, E. C., Scazella, E., & Zanalda, A. Il test PM 38 (Raven) nell 'eta' avanzata (1). *Il Lavoro Neuropsichiatrico*, 1962, 30, 2.
- Baraheni, M. N. Raven's Progressive Matrices as applied to Iranian children. *Educational and Psychological Measurement*, 1974, 34, 983-988.
- Bartlett, D. P., Newbrough, J. R., & Tulkin, S. R. Raven Progressive Matrices: An item and set analysis of subjects grouped by race, sex, and social class. *Journal of Consulting and Clinical Psychology*, 1972, 38, 154.
- Berry, J. W. Ecological and cultural factors in spatial perceptual development. *Canadian Journal of Behavioral Science*, 1971, 3, 324-336.
- Brandis, W., & Henderson, D. *Social class, language and communication*, London. Routledge and Kegan Paul, 1970.
- Bruni, P. Uno studio sulle possibilità del D. 48 nella Scuola Media, (A study on the application of the D48 in Secondary School). *Bolletino di Psicologia Applicata*, 1966, 77-78, 157-169.
- Bruni, R. Working percentiles based on 931 Italian children. *Personal communication*, 1954.
- Byrt, E., & Gill, P. E. *Standardization of Raven's Standard Progressive Matrices and Mill Hill Vocabulary (Synonym selection) for the Irish population: Ages 6-12*. To appear. Based on thesis work at University College, Cork, 1973.
- Cantwell, Z. M. The performance of American pupils on the Coloured Progressive Matrices. *British Journal of Educational Psychology*, 1967, 37, 389-390.
- Chang, Chun-Hsing. Effects of discovery approach of science instruction on elementary school children's logical thinking development. *Bulletin of Educational Psychology*, 1975, 8, 11-24.
- Chang, Chun-Hsing. Sex differences of children in school learning as related to sex differences of teachers: An analytical study of effect of availability of sex-role identification model on children's school learning. *Bulletin of Educational Psychology*, 1976, 9, 1-20.

- Chauffard-Bennassy, C. Rigidité ou plasticité des aptitudes chez l'enfant. *Enfance*, 1949, 3, 202-221.
- Conrad, R. *The deaf schoolchild: Language and cognitive function*. New York: Harper and Row, 1979.
- Corman, L. & Budoff, M. Factor structures of Spanish-speaking and non-Spanish-speaking children on Raven's Progressive Matrices. *Educational and Psychological Measurement*, 1974, 34, 977-981.
- Crawford, A. An analysis of children's wrong answers on Raven's Progressive Matrices test, 1938. Proceedings: Annual Conference, B. P. S., Durham, 1955.
- Das, J. P., Kirby, J. R., & Jarman, R. F. *Simultaneous and successive cognitive processes*. New York: Academic Press, 1979.
- De, B., & Kala, C. Development of local norms for the Coloured Progressive Matrices. *Journal of Vocational and Educational Guidance*, 1971, 14, 1-10.
- DeFries, J. C., Johnson, R. C., Kuse, A. R., McClearn, G. E., Polovina, J., Vandenberg, S. G., & Wilson, J. R. Familial resemblance for specific cognitive abilities. *Behavior Genetics*, 1979, 9, 23-43.
- Deshpande, M. V. Sex differences on Raven's Matrices Test. *Journal of Psychological Researches*, 1971, 15, 101-103.
- Di Fiore, E., & Renda, S. Etude sur l'applicabilité de quelques tests en orientation professionnelle. (Study of the applicability of several tests in vocational guidance). *Bulletin de Psychologie Scolaire et d'Orientation*, 1969, 18, 257-271.
- Eggert, D. Entwicklung einer Testbatterie für geistig behinderte Kinder. In Duhm, E. (Hrsg), *Praxis der Klinischen Psychologie*, Bd 1. Gottingen: Hogrefe, S. 55-81. 1969.
- Elkin, L. Predicting performance of the mentally retarded on sheltered workshop and non-institutional jobs. *American Journal of Mental Deficiency*, 1968, 72, 533-539.
- Elley, W. B., & MacArthur, R. S. The Standard Progressive Matrices as a culture-reduced measure of general intellectual ability. *Alberta Journal of Educational Research*, 1962, 8, 54-65.
- Eysenck, H. J. Neurosis and intelligence. *Lancet*, 1943, 245, 362-363.
- Foulds, G. A. Progressive Matrices and the Mill Hill Vocabulary Scale as a diagnostic aid among psychiatric patients. *British Journal of Social and Clinical Psychology*, 1970, 9, 80-82.
- Foulds, G. A., & Dixon, P. The nature of intellectual deficit in schizophrenia Pt. I, A comparison of schizophrenics and neurotics. *British Journal of Social and Clinical Psychology*, 1962, 1, 7-19.
- Foulds, G. A., Dixon, P., McClelland, M., & McClelland, W. J. The nature of intellectual deficit in schizophrenia: Pt. 2. A cross-sectional study of paranoid, catatonic, hebephrenic and simple schizophrenics. *British Journal of Social and Clinical Psychology*, 1962, 1, 141-149.

- Freyburg, P. S. The efficacy of the Coloured Progressive Matrices as a group test with young children. *British Journal of Educational Psychology*, 1966, 36, 171-177.
- Garrity, L. I., & Donaghue, J. T. Preschool children's performance on the Raven's Coloured Progressive Matrices and the Peabody Picture Vocabulary Test. *Educational and Psychological Measurement*, 1976, 36, 1043-1047.
- Georgas, J. G. *Standardization of a Vocabulary Intelligence Test* (unpublished final progress report, research MH 12544-01) The Athenian Institute of Anthropolos, 8 Demetriou Soutsou St., Athens, 602, Greece, 1970.
- Georgas, J. G., & Georgas, C. A children's intelligence test for Greece. Chapter 22 in Cronbach, L. J. C. and Drenth, P. J. D., *Mental Tests and cultural adaptation*. The Hague: Mouton, 1972, pp. 217-222.
- Ghuman, P. A. An exploratory study of Witkin's dimension in relation to social class, personality factors and Piagetian tests. *Social Behaviour and Personality*, 1977, 5, 87-91.
- Gill, P. Progressive Matrices in Ireland. *Proceedings of XXIst International Congress of Psychology*, Paris, 1976.
- Goetzinger, M. R., & Houchins, R. R. The 1947 Coloured Raven's Progressive Matrices with deaf and hearing subjects. *American Annals of the Deaf*, 1969, 114, 95-101.
- Guttman, R. Genetic analysis of analytical spatial ability: Raven's Progressive Matrices. *Behaviour Genetics*, 1974, 4, 273-284.
- Guttman, R., & Shohan, I. Intrafamilial invariance and parent-offspring resemblance in spatial abilities. *Behaviour Genetics*, 1979, 9, 367-378.
- Harris, D. B. A note on some ability correlates of the Raven Progressive Matrices (1947) in the kindergarten. *Journal of Educational Psychology*, 1959, 50, 228-229.
- Heron, A. & Chown, S. *Age and function*. London: Churchill, 1967
- Higgins, C., & Sivers, C. H. A comparison of Stanford-Binet and Coloured Raven Progressive Matrices I.Q.'s for children with low socio-economic status. *Journal of Consulting Psychology*, 1958, 22, 465-468.
- Himmelweit, H. T. Speed and accuracy of work as related to temperament. *British Journal of Psychology*, 1946, 36, 132-144.
- Jensen, A. R. The race x sex x ability interaction. In R. Cancro (Ed.), *Intelligence: Genetic and environmental influences*. New York and London: Grune and Stratton, 1971.
- Johnson, E. Z. Sex differences and variability in the performance of retarded children on Raven, Binet and Arthur tests. *Journal of Clinical Psychology*, 1952, 8, 298-301.
- Kanekar, S. Academic performance in relation to anxiety and intelligence, *Journal of Social Psychology*, 1977, 101, 153-154.
- Kear-Colwell, J. J. The B factor scale of the 16 PF as a measure of intelligence in psychiatric patients. *Journal of Clinical Psychology*, 1970, 26, 477-479.

- Kennedy, R. J. *Sex differences in performance on the Raven's Progressive Matrices Test*. B. A. (Hons.) Thesis, Flinders University, S. Australia, 1972.
- Kerr, A. S. Determinants of performance of the Bender Gestalt Test and Raven's Progressive Matrices (1947) test. *Journal of Learning Disabilities*, 1972, 5, 219-221.
- Kilburn, K. L., Sanderson, R. E., & Melton, K. Relations of the Raven Coloured Progressive Matrices to two measures of verbal ability in a sample of mildly retarded hospital patients. *Psychological Reports*, 1966, 19, 731-734.
- King, W. H. The development of scientific concepts in children. *British Journal of Educational Psychology*, 1963, 33, 240-252.
- Kirby, J. R., & Das, J. P. Skills underlying Coloured Progressive Matrices. *Alberta Journal of Educational Research*, 1978, 24, 94-99.
- Klauer, K. J. Der Progressive-Matrices-Test bei Volks-und-Hilfsschulkindern. *Heilpädagogische Forschung*, 1964, 1, 13-37.
- Kline, P. *Psychometrics and psychology*, London: Academic Press, 1979.
- Klingelhofer, E. L. Performance of Tanzanian secondary school pupils on the Raven Standard Progressive Matrices Test. *Journal of Social Psychology*, 1967, 72, 205-215.
- Klippel, M. D. Measurement of intelligence among three New Zealand ethnic groups. *Journal of Cross-Cultural Psychology*, 1975, 6, 365-376.
- Kundu, R., & Sen, A. Matrices score with time limit and without time limit and its relationship with multiplication score. *Journal of Psychological Research*, 1964, 8, 120-123.
- Kurdek, L. A. Structural components and intellectual correlates of cognitive perspective taking in first through fourth-grade children. *Child Development*, 1977, 48, 1503-1511.
- Kuroda, J. Applications of the Coloured Progressive Matrices test for the Japanese Kindergarten children. *Psychologia*, 1959, 2, 173-177.
- Langevin, R. Is curiosity a unitary construct? *Canadian Journal of Psychology*, 1971, 25, 360-374.
- Levine, B., & Iscoe, I. A comparison of Raven's Progressive Matrices (1938) with a short form of the Wechsler-Bellevue. *Journal of Consulting Psychology*, 1954, 18, 10.
- Levine, B., & Iscoe, I. The Progressive Matrices (1938), the Chicago Non-Verbal and the Weschler-Bellevue on an adolescent deaf population. *Journal of Clinical Psychology*, 1955, 11, 307-308.
- Levinson, B. A comparative study of the verbal and performance ability of monolingual and bilingual native born Jewish preschool children of traditional parentage. *Journal of Genetic Psychology*, 1960, 97, 93-112.
- Lingwood, J. Test performances of A. T. S. recruits from certain civilian occupations. *Occupational Psychology*, 1952, 26, 35-46.
- MacArthur, R. S. *Mackenzie District Norming Project*. Ottawa: Department of Northern Affairs and National Resources, 1965.

- MacArthur, R. S. Some cognitive abilities of Eskimo, White and Indian-Metis pupils aged 9 to 12 years. *Canadian Journal of Behavioural Science*, 1969, 1, 50-59.
- MacArthur, R. S. Ecology, culture and cognitive development: Canadian native youth. In L. Driedger (Ed.), *The Canadian ethnic mosaic*. Toronto: McClelland and Stewart, 1978.
- MacArthur, R. S., Irvine, S. H., & Brimble, A. R. *The Northern Rhodesia Mental ability survey, 1963*. (Rhodes-Livingstone Communication No. 27) Lusaka: Rhodes-Livingstone Institute, 1964.
- McLeod, H. N., & Rubin, J. Correlation between Raven Progressive Matrices and the WAIS. *Journal of Consulting Psychology*, 1962, 26, 190-191.
- Malpass, L. F., Brown, R., Hake, D. The utility of the Progressive Matrices (1956 Edition) with normal and retarded children. *Journal of Clinical Psychology*, 1960, 16, 350.
- Marjoribanks, K. Birth order, age spacing between siblings and cognitive performance. *Psychological Reports*, 1978, 42, 114-123.
- Milgram, N. A. Locus of control in Negro and White children at four age levels. *Psychological Reports*, 1971, 29, 459-465.
- Mills, P. A. Raven's Coloured Progressive Matrices: Sex differences and performance. A South Australian study and a review of other evidence. Unpublished research dissertation, Flinders University of S. Australia, 1978.
- Mohan, V. Raven's Standard Progressive Matrices and a verbal test of general mental ability. *Journal of Psychological Researches*, 1972, 16, 67-69.
- Mohan, V., & Bhanot, A. Qualitative differences in the performance of introvert and extrovert children on continuous tasks. *Asian Journal of Psychology and Education*, 1976, 1, 23-29.
- Mohan, V., & Kumar, D. Qualitative analysis of the performance of introverts and extraverts on Standard Progressive Matrices. Paper read to the Indian Science Congress, Chandigarh, 1973.
- Mohan, V. & Kumar, D. Qualitative analysis of the performance of introverts and extraverts on Standard Progressive Matrices. *British Journal of Psychology*, 1976, 67, 391-397.
- Mohan, V., & Kumar, D. Performance of neurotics and stables on the Standard Progressive Matrices. *Intelligence*, 1979, 3, 355-368.
- Molloy, G. N., & Das, J. P. Intellectual abilities and process: An exploratory study with implications for person-teaching method interactions. *Australian Journal of Education*, 1979, 23, 83-92.
- Montgomery, G. W. The relationship of oral skills to manual communication in profoundly deaf students. *American Annals of the Deaf*, 1966, 11, 557-565.
- Morgan, E. R. *Bilingualism and non-verbal intelligence*. Pamphlet No. 4, Faculty of Education, University College of Wales, Aberystwyth, 1957.
- Muller, R. Eine kritische empirische Untersuchung des "Draw-a-man Test" und der "Coloured Progressive Matrices". *Diagnostica*, 1970, 16, 138-147.

- Myers, R., & Goldstein, D. Cognitive development in bilingual and monolingual lower-class children. *Psychology in the Schools*, 1979, 16, 137-142.
- Nathan, M., & Schnabl, A. The effect of kibbutz children's age and sex on performance in the Raven's Progressive Matrices test. *The Kibbutz*, 1976, 3-4, 105-113.
- Norman, R. D., & Midkiff, K. L. Navaho children on Raven Progressive Matrices and Goodenough Draw-a-man tests. *Southwestern Journal of Anthropology*, 1955, 11, 129-136.
- Orton, R., & Martin, D. R. Psychiatric screening of medical students. *Lancet*, 1948, 255, 321-323.
- Panek, P. E., & Stoner, S. B. Age differences on Raven's Coloured Progressive Matrices. *Perceptual and Motor Skills*, 1980, 50, 977-978.
- Petersen, L. An investigation into the applicability of the norms associated with the Standard Progressive Matrices and the Mill Hill Vocabulary Scale for modern Australian testees. Honours Thesis, University of Adelaide, 1971.
- Rao, Y. R. Distribution of Progressive Matrices scores among pupils of XI standard. *Indian Journal of Applied Psychology*, 1975, 12, 76-82.
- Rao, S. N., & Reddy, I. K. S. Development of norms for Raven's Coloured Progressive Matrices test (booklet form) on elementary school children. *Psychological Studies*, 1968, 13, 105-107.
- Raven J. The 1979 standardization of the Standard Progressive Matrices and Mill Hill Vocabulary Scales. Research Supplement No. 1 to the Manual for *Raven's Progressive Matrices and Vocabulary Scales*. London: H. K. Lewis, 1981.
- Raven, J. C. The R. E. C. I. series of perceptual tests: An experimental survey. *British Journal of Medical Psychology*, 1939, 18, 16-34.
- Raven, J. C. Raven's Intelligence Test. *British Medical Journal*, 1947, 4510, 872.
- Raven, J. C. The comparative assessment of intellectual ability. *British Journal of Psychology*, 1948, 39, 12-19.
- Raven, J. C. *The Advanced Progressive Matrices*. London: H. K. Lewis, 1963.
- Raven, J. C., Court, J. H., & Raven J. *Manual for Raven's Progressive Matrices and Vocabulary Scales*. London: H. K. Lewis, 1977.
- Rawlinson, B. A cross-cultural study of intelligence in Papua New Guinea and Tasmania. *New Guinea Psychologist*, 1974, Monograph Supplement 6, 46.
- Rich, C., & Anderson, R. P. A tactual form of the Progressive Matrices for use with blind children. *Personnel and Guidance Journal*, 1965, 43, 912-919.
- Richardson, H. J. *Adolescent girls in approved schools*. London: Routledge and Kegan Paul, 1969.
- Rimoldi, H. J. A. Ensayo de tipificación de una prueba mental. (Progressive Matrices de Raven) *Publicaciones del Instituto de Psicología Experimental* (Universidad Nacional de Cuyo), 1945, 1, 85-114.

- Rimoldi, H. J. A. Tipificación de los Progressive Matrices de Raven. *Publicaciones del Instituto de Psicología Experimental*, 1947, 2, 1.
- Rohwer, W. D., Ammon, M. S., Suzuki, N., & Levin, J. R. Population differences and learning proficiency. *Journal of Educational Psychology*, 1971, 62, 1-14.
- Schmidtke, A., Schaller, S., & Becker, P. Manual: *Raven-Matrizen-Test. Coloured Progressive Matrices*. Beltz Test: Gesellschaft Weinheim, 1978.
- Semler, I. J., & Iscoe, I. Structure of intelligence in negro and white children. *Journal of Educational Psychology*, 1966, 57, 326-336.
- Sigel, I. E. How intelligence tests limit understanding of intelligence. *Merrill-Palmer Quarterly*, 1963, 9, 39-56.
- Simon, A., & Ward, L. O. Age, sex, intelligence and religious beliefs in 11 to 15 year old pupils. *Irish Journal of Education*, 1975, 9, 108-114.
- Sinha, U. The use of Raven's Progressive Matrices test in India. *Indian Educational Review*, 1968, 3, 75-88.
- Sinha, M., & Chandrakala. Correlations between Harris' and Burt's Draw-a-man scales and some other measure of intelligence. *Journal of Psychological Researches*, 1972, 16, 116-120.
- Sitkei, E. G., & Michael, W. B. Predictive relationships between items on the Revised Stanford-Binet Intelligence Scale (SBIS), Form L-M, and total scores on Raven's Progressive Matrices (PM), between items on the PM and total scores on the SBIS, and between selected items on the two scales. *Educational and Psychological Measurement*, 1966, 26, 501-506.
- Spearman, C. *The nature of intelligence and the principles of cognition*. London: MacMillan and Co., 1923.
- Sperrazzo, G., & Wilkins, W. L. Further normative data on the Progressive Matrices. *Journal of Consulting Psychology*, 1958, 22, 35-37.
- Sperrazzo, G., & Wilkins, W. L. Racial differences on Progressive Matrices. *Journal of Consulting Psychology*, 1959, 23, 273-274.
- Stachyra, J. The mental development of deaf children. *Roczniki Filozoficzne*, 1971, 19, 101-114.
- Surrey Educational Research Association. Analysis of Raven's Matrices scores. Preliminary report, (unpublished), 1978.
- Sweet, R. *Some recent adolescent and adult norms for the PM 38*. Research Report: Division of student services, Sydney Technical College. Mimeo, 5 pp. 1976.
- Sydiaha, D. Prediction of WAIS I.Q. for psychiatric patients using the Ammons' FRPV and Raven's Progressive Matrices. *Psychological Reports*, 1967, 20, 823-826.
- Szegedi, M. A Raven-fele intelligencia teszt érvényességének statisztikai vizsgálat a hazai szüroproba tukreben. *Magyar Pszichologiai Szemle*, 1974, 31, 194-201.

- Tesi, G., & Young, H. B. A standardization of Raven's Progressive Matrices 1938 (revised 1956). *Archivio di Psicologia Neurologia e Psichiatria*, 1962, 5, 455-464.
- Tuddenham, R. D., Davis, L., Davison, L., & Schindler, R. An experimental group version for school children of the Progressive Matrices. Abstract: *Journal of Consulting Psychology*, 1958, 22, 30.
- Tulkin, S. R., & Newbrough, J. R. Social class, race and sex differences on the Raven (1956) Standard Progressive Matrices. *Journal of Consulting and Clinical Psychology*, 1968, 32, 400-406.
- Turner, G. H., Hall, V.C., & Grimmet, S. Effects of familiarization feedback on the performance of lower-class and middle-class kindergarteners on the Raven's Coloured Progressive Matrices. *Journal of Educational Psychology*, 1973, 65, 356-363.
- Valentine, M. Psychometric testing in Iran. *Journal of Mental Science*, 1959, 105, 93-107.
- Valseschini, S., & Delton, F. *Le Matrici Progressive di Raven*. Universiti di Milano, Edizioni Firenze, 1973.
- Van Dam, F. Le "Advanced Progressive Matrices I and II" de J. C. Raven an niveau des premières candidatures en sciences. *Revue Belge de Psychologie et de Pédagogie*, 1976, 38, 1-12.
- Vandenberg, S.G., & Price, R. A. Replication of the factor structure of the Comrey Personality Scales. *Psychological Reports*, 1978, 42, 343-352.
- Vejleskov, H. An analysis of Raven Matrix responses in fifth grade children. *Scandinavian Journal of Psychology*, 1968, 9, 177-186.
- Wetherick, N. E. Structure and content in concept attainment: Effects of varying problem content. *British Journal of Psychology*, 1967, 58, 223-226.
- Wiltshire, E. B., & Gray, J. E. Draw-a-man and Raven's Progressive Matrices (1938) Intelligence Test performance of reserve Indian children. *Canadian Journal of Behavioural Sciences*, 1969, 1, 119-122.
- Winkelmann, W. Normen für den Mann-Zeichen-Test von Ziler und die Coloured Progressive Matrices von Raven für 5-7 jährige kinder. *Psychologische Beiträge*, 1972, 14, 80-93.
- Wittenberg, J. J. Die Progressive Matrices 1947. In Wellek, A. (Hrsg). *Bericht über Den 21. Kongress der Deutschen Gesellschaft für Psychologie*. Göttingen: Hogrefe, S. 1958, 255-258.
- Young, H. B., Tagiuri, R., Tesi, G., & Montemagni, G. Influence of town and country upon children's intelligence. *British Journal of Educational Psychology*, 1962, 32, 151-158.
- Ziv, A. Sex differences in performance as a function of praise and blame. *Journal of Genetic Psychology*, 1972, 120, 111-119.

The History and Development of CAI: 1926-1981, An Overview

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Computer aided instruction (CAI) is increasingly being used in the classroom in the 1980's. From preschool to post-graduate education the computer has found a growing niche in the classroom. Déjà vu? Perhaps, because CAI has been in the classroom before. That those who are not aware of its past are bound to repeat it has been woefully noted by educators. The purpose of this paper is to present an overview of the history of CAI so that those educators who are using CAI may be more aware of where it has been and may be better able to guide the development and application of CAI in the future.

Early Teaching Machines

The history of computer aided instruction is inextricably mixed with and related to the histories of both education and computers. Because of this and the fact that these two histories developed independently and at different rates, the history of CAI does not easily lend itself to a straightforward didactic discourse. However, a brief chronological overview, which focuses upon significant individuals and programs in this area, will be presented.

This overview begins in the mid 1920's with Pressey. As suggested by the title of his first article "A Simple Apparatus Which Gives Tests and Scores — and Teaches" (Pressey, 1926), Pressey was interested in designing mechanical devices which could automatically provide drill and practice items to students in order to:

Lift from her [the teacher's] shoulders as much as possible of this burden [drill and "information-fixing"] and make her freer for those inspirational and thought-stimulating activities which are, presumably, the real function of the teacher. (p. 373)

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Pressey did not only have an interest in saving time for the teacher, but was also keenly interested in delivering “individualized” instruction as can be noted in the instructional paradigm he “programmed” into his machine:

An apparatus for teaching drill material which (a) should keep each question or problem before the learner until he finds the correct answer, (b) should inform him at once regarding the correctness of each response he makes, (c) should continue to put the subject through the series of questions until the entire lesson has been learned, but (d) should eliminate each question from consideration as the correct answer for it has been mastered (Pressey, 1927, p. 552).

It should be noted that some may object to even including Pressey’s teaching machines in the history of CAI because these machines were mechanical in nature and computers, by definition, are electronic. However, the early contribution Pressey made by integrating the notions of machines and learning, as well as his introduction of a mastery learning paradigm into his “teaching machines,” are the major reasons for beginning the overview of the history of CAI with Pressey.

Many individuals experimented with several types of teaching machines over the next two decades, but it was not until the 1950’s that the next significant contribution to the history of CAI occurred. Skinner’s experimental work in the area of stimulus-response and reinforcement was the next major development which further contributed to an understanding of the usefulness and the application of teaching machines. In a paper presented at a psychology conference in 1954, Skinner noted that the relationship and importance of reinforcement to learning had been well documented, yet the classroom environment was relatively devoid of its use. He further noted that the teacher, because of class sizes and the styles of teaching and grading being used, was not likely to succeed in properly implementing increased reinforcement (Skinner, 1954). Skinner then stated that:

If the teacher is to take advantage of recent advances in the study of learning, she must have the help of mechanical devices.

The technical problem of providing the necessary instrumental aid is not particularly difficult. There are many ways in which the necessary contingencies may be arranged, either mechanically or electrically. An inexpensive device which solves most of the principal problems has already been constructed. . . . The important features of the device are these: Reinforcement for the right answer is immediate. The mere manipulation of the device will probably be reinforcing enough to keep the average pupil at work for a suitable period each day, provided traces of earlier aversive control can be wiped out. A teacher may supervise an entire class at work on such devices at the same time, yet each child may progress at his own rate, completing as many problems as possible within the class period. If forced to be away from school, he may return to pick up where he left off. The gifted child will advance rapidly, but can be kept from getting too far ahead either by being excused from arithmetic for a time or by being given special sets of problems which take him into some of the interesting bypaths of mathematics.

The device makes it possible to present carefully designed material in which one problem can depend upon the answer to the preceding and where, therefore, the most progress to an eventually complex repertoire can be made. (Skinner, 1954, p. 95)

In conclusion, Skinner advocated that mechanized instruction should be integrated into all schools, not as a replacement for, but as an adjunct to the teacher.

Research in the “Teaching Machine Project” at the IBM research center during the late 1950’s led to the development and application of an IBM 650, a high-speed digital computer, as a teaching machine. A typewriter was interfaced to the IBM 650 and this configuration was known as the “IBM 650 Inquiry Station.”

The IBM 650 Inquiry Station is a typewriter and a console which is capable of transmitting typed information to the computer and receiving information from the computer. The student sits at the Inquiry Station. The program of instructions in the computer presents the problem to the student by way of the typewriter. The student, in turn, types his answer, which is transmitted to the computer for checking. (Rath, Anderson & Brainerd, 1959, p. 126)

The subject matter taught by this early CAI system was binary arithmetic. It should be noted that this system required “running one *S* [student] in real time with the computer,” however, the authors noted that the computer spent most of its time waiting for the student to respond and could probably be multiplexed in order to “present and score problems for several students who sat at different inquiry stations” (Rath et al., 1959, p. 129).

Needless to say, other educational technologies had also been invented and developed during the twenties, thirties, forties, and fifties. In addition, diverse and physically different types of “teaching machines” had been developed, but as different from one another as they may have appeared physically, the teaching machines maintained several unifying and identifying characteristics.

In the review, “Teaching Machines and Self-Instructional Materials,” Lumsdaine (1959) identified three major properties which distinguished the teaching machines from films, television, and other audiovisual media:

First, continuous active student response is required, providing explicit practice and testing of each step of what is to be learned.

Second, a basis is provided for informing the student with minimal delay whether each response he makes is correct, leading him directly or indirectly to correction of his errors.

Third, the student proceeds on an individual basis at his own rate — faster students romping through an instructional sequence very rapidly, slower students being tutored as slowly as necessary, with indefinite patience to meet their special needs. (p. 164)

Thus by the beginning of the 1960’s, the knowledge, understanding, and potential application of CAI had been fairly well identified and subjected to preliminary testing by both engineers and psychologists. However, in spite of the progress made by engineers and psychologists in designing teaching machines and analyzing their effect on learning, Pressey’s “hope” and Skinner’s “encouragement” were not generally heeded by educators, and by 1960 “teaching machines” still had not found a niche in the classroom.

Dick (1965) noted that “computer instruction offers an almost unlimited area of research into individual differences” (p. 44). He further, perhaps optimistically, stated that “Skinner has said that cultural inertia blocked the use of Pressey’s teaching machines in the twenties. Our culture is apparently ready for Skinner’s machines in the sixties” (p. 53).

Dedicated CAI Systems in the 1960's

CAI was attempted in a variety of subject matter on virtually every type of computer in use in the 1950's and 1960's (for example: Licklider, 1962; Morrison & Adams, 1968; Schurdak, 1967; Stolurow, 1967). However, two major systems in particular, the IBM 1500 and PLATO, were developed specifically for CAI in the early 1960's and contributed significantly to its use.

Early collaborative work between the Institute for Mathematical Studies in the Social Sciences (IMSSS) at Stanford University, under the direction of Richard Atkinson and Patrick Suppes, and the International Business Machine (IBM) Corporation led to the development of the IBM-1500 Instructional System. The system consisted of: a central process computer; a disc storage unit; a magnetic tape unit; a card read-punch unit; a printer; an audio control unit; two proctor stations; and sixteen student stations. Each student station consisted of: a cathode ray tube display screen; a picture projector with rear image screen; a modified typewriter keyboard with certain added function keys; a light pen; and an audio system. The proctor stations were similar to the student stations except that they did not contain the audio or film projector units (Atkinson, 1968).

Initially, the IBM 1500 Instructional System was used to teach reading (Atkinson & Hansen, 1966) and mathematics (Suppes, 1966) to primary school students. Other programs and courses, however, rapidly developed including college and university level courses, i.e. Russian (Suppes & Morningstar, 1969).

At about the same time that the IBM 1500 Instructional System was being developed another cooperative research group was at work on a different CAI system. This group, consisting of members from the University of Illinois, under the direction of Donald Bitzer, the Control Data Corporation (CDC), and the National Science Foundation, began work in the early 1960's on the PLATO System.

PLATO (Programmed Logic for Automatic Teaching Operations) was developed to deliver CAI via a large mainframe or macro-computer system as opposed to a mini-computer (i.e. the IBM 1500). By utilizing this larger computer system it was possible to have a much larger library of programs immediately available for student use; to utilize more easily sophisticated programs to automatically keep track of an individual student's progress in a series of CAI programs; and to provide access to many times more students than was possible with a mini-computer system (i.e. a ten- to fifty-fold increase in the potential number of simultaneous users).

The early PLATO II System ran on the ILLIAC I computer at the University of Illinois. This system had a "high speed electrostatic memory of 1024 40-bit words and an auxiliary magnetic drum storage of 10,240 words" (Bitzer, Braunfel & Lichtenberger, 1962, p. 206). Students communicated with the system by means of a keyboard which contained alphanumeric characters and a special set of function keys (i.e. continue, help, aha). Feedback and new material or questions were presented to each student via closed circuit television. Slides and alphanumeric characters could be simultaneously superimposed on the students' screen. A major feature of this system was that it could instruct a number of students concurrently, while the PLATO I originally had only one student terminal connected to it.

The next PLATO System, also developed in the 1960's, consisted of a large CDC 1604 mainframe computer and a number of remote student terminal

stations. Each station consisted of: a plasma terminal display screen capable of detecting areas which were touched (as in pointing to an answer on the screen); a modified typewriter keyboard with certain added function keys; and a computer-controlled electronic slide selector. Other peripheral devices (i.e. film projectors, audio units) could be interfaced to the student terminal station and placed under computer control if necessary. An added feature of the system was the ability to have communication between the various terminals transmitted via the central computer.

Despite the advances made by the IBM 1500 Instructional System and PLATO, as well as numerous other individual achievements and developments in the area of CAI, the role of the computer in education, contrary to Dick's (1965) prediction, was minimal in the 1960's. Were then the 1970's to become the "Age of CAI"? Certainly many leading authorities in the field of CAI (Bitzer & Bitzer, 1973; Suppes, 1966) thought so: "Within the next decade teachers and computers will become educational partners" (Hicks & Hunka, 1972, p. 20).

Application of Microcomputers in the 1970's

The major developments during the 1970's which bode well for CAI were the development of the TICCIT System and educationally oriented microcomputers.

During the early 1970's another co-operative research effort between a University based group and a private corporation yielded a significant contribution to the field of CAI. The groups involved were a group from Brigham Young University, under the direction of Victor Bunderson, and a group from the MITRE Corporation. The result of this co-operative effort was the Time-shared, Interactive, Computer-Controlled, Information Television (TICCIT) System of CAI (Suppes & Macken, 1978).

TICCIT was originally a 32 terminal minicomputer based CAI system which used the television as the display device by which it delivered CAI programs to student users. The original subject matter consisted of English and mathematics programs intended for students at the junior or community college level (Suppes & Macken, 1978).

A major contribution made by the TICCIT System to CAI was not in the hardware or courseware which it used per se, but in its application of a theory for instruction as its base. The hardware as well as the courseware which ran on the system, was based on a theory for instruction developed by M. David Merrill (Merrill, 1980; Reigeluth, 1979). This theory for instruction was primarily concerned with strategies for teaching a single concept or principle. According to this theory:

Any particular instance of a complex cognitive instructional presentation must always feature some combination of presentation mode and content. The qualitative values are expository (E), inquisitory (I), generality (G), and instance (eg). Combining them into a two-way table will produce the following presentations: expository generality (EG), expository instance (Eeg), inquisitory generality (IG), and inquisitory instance (Ieg). In an expository-generality (EG) presentation, S [student] is presented definitions or rules and directed to study or read these generalities. In an expository-instance (Eeg) presentation, S is presented exemplars or nonexemplars of a given concept along with some indication of appropriate class membership or a sample of the application of a rule to a particular problem. This presentation may be in the form of questions, if the answer is given at the same time. In an inquisitory-generality

(IG) presentation, the student is asked to reproduce or deduce the definition or rule. . . . In an inquisitory-instance (Ieg) presentation, S is presented an exemplar or nonexemplar of a concept and asked to indicate class membership, or he is given a problem and asked to apply the rule. (Merrill & Boutwell, 1973, pp. 106-107)

TICCIT applied this theory to an instructional paradigm with the assumption that "a given idea concept, procedure, or principle — should be presented in each of three modes: rule, example, and practice" (Merrill, 1980, p. 77).

This was the first time, since the application of Pressey's simple mastery paradigm and Skinner's immediate reinforcement to the early teaching machines, that CAI formally and rigorously attempted to base its operations in instructional theory. TICCIT thus became the first CAI system to be extensively based in instructional theory (Reigeluth, 1979).

The other major CAI development during the 1970's was the development of microcomputers. Microcomputers are basically a scaled down or unit version of large computers. They are relatively small and possess stand alone computer facilities with a minimum amount of hardware. Basically this includes a microprocessor with a display screen and a keyboard for data entry.

Micro-electronic and silicon chip technology, developed in the early 1970's, resulted in the development of microprocessors, which possessed the power of the older and physically several hundred-fold larger computer processors, but at a cost several hundred-fold less (Vacroux, 1975; Wagner, 1976). This opened the door for the development of microcomputers and by 1975 the first commercially available microcomputers, the Altair 8800, the Intellec-8, and the Motorola Microcomputer, were released in kit form ready for the consumer to assemble. Others (i.e. Heathkit, SOL) rapidly became available at lower and lower costs. However, because of the expertise and time necessary to properly assemble one of these units few educators took advantage of them to deliver CAI, although use was made of these kits in vocational education, electronics, and computer science courses.

This changed in 1977 with the appearance of the PET 2001 microcomputer by Commodore. This was a fully assembled and tested microcomputer which could appeal to the general consumer or educator without the necessity of computer or electronics knowledge. Others which appeared at about the same time in ready to run form included: Apple, Compucolor, Datapoint, Exidy Sorcerer, IMSAI, SOL (by Processor Technology), and TRS-80 (by Radio Shack).

The microcomputer did much to promote CAI, both directly and indirectly. Because of the microcomputer's attractive features (i.e. portability, self-containment, low cost), it produced a wider interest in the use of CAI among educators than had any of the previous types of CAI delivery systems. Thus, many schools had their first, and perhaps only, contact with CAI because of and by means of the microcomputer.

Indirectly, the microcomputers contributed to CAI both within and outside the educational community by making CAI technology available at an affordable price to lay individuals and educators alike. This in turn resulted in the desire of interested individuals to learn more about microcomputers and their potential applications, including CAI, and a need for vehicles by which this information could be communicated.

In response to this need, numerous publications, clubs, and organizations devoted primarily to microcomputers and/or CAI were developed in the 1970's. The journals included titles such as: *Byte*, *Dr. Dobb's Journal*, *Interface Age*, *Kilobaud Microcomputing*, and *Personal Computing*. The clubs, primarily lay or hobbyist oriented, produced newsletters and publications and sponsored "personal computer conferences" and "computer fairs." Many professional organizations which were started or expanded during the 1970's (i.e. Association for the Development of Computer-Based Instruction Systems [ADCIS], Association for Educational Data Systems [AEDS]) owe a great deal to the interest in CAI generated by the development of microcomputers.

A further, perhaps larger and more important, "ripple" effect which the microcomputers have had on CAI was that of increasing public awareness of computers in general. This ultimately will probably be the most significant contribution which the microcomputers will have in promoting CAI, that is: to decrease the "societal inertia" which had hitherto hindered the growth of CAI.

Despite these advances CAI continued to be the exception, rather than the rule, in the classroom during the 1970's. This situation certainly was not expected, as witnessed by earlier predictions, nor can it be easily explained. The technology and instructional psychology of CAI had developed sufficiently to warrant its widespread use and societal (especially student user) inertia seemed to be minimal. Educational funding cutbacks during the 1970's certainly may have contributed to the situation. A tempting speculation is that educators themselves were primarily responsible for this situation (Norris, 1978).

Current Status

What of the 1980's? It is still too early to predict whether or not this decade will see CAI become widely and routinely integrated into the instructional system. The first two years have seen both advances and retreats for CAI.

The current state of affairs for CAI in the 1980's will begin with a review of the progress and status of two major dedicated CAI systems, the IBM 1500 Instructional System and PLATO.

The IBM 1500 Instructional Systems were extensively used and tested by educators and researchers from the mid-1960's through the 1970's. Major centers of application and development included Stanford University, Florida State University, Pennsylvania State University, and the University of Alberta. Despite the 1500's ability to deliver highly sophisticated CAI, the IBM Corporation discontinued support for the system and the last one was removed from service at the University of Alberta in 1980. This system was not replaced by IBM with another dedicated CAI system.

The PLATO system, on the other hand, has continued to develop since its inception in the early 1960's. Since that time it has shown steady increases in the quality and variety of CAI courses available on it. The 1981 catalog of published PLATO courses contained over seven hundred entries in disciplines ranging from astronomy to veterinary science. In addition, many times this number of programs exist in an unpublished form, available on a restricted basis at the various universities and centers which utilize the PLATO system.

Various central computers have been utilized by the PLATO system including the CDC 1604, the CDC 6400, the CDC CYBER 74, the CDC CYBER 170, and the CDC CYBER 172. PLATO hardware and software changes, now entering their

fifth generation, have enabled the system to keep pace with growing numbers of student users so that from an early capacity of 20 simultaneous student users, the maximum system configuration is now capable of supporting over six hundred terminals simultaneously at an acceptable performance level, and can theoretically support over one thousand simultaneous users. Major centers which now have PLATO computer or terminal facilities include: the Universities of Alberta, Arizona, Belgium, Colorado, Delaware, Finland, Florida State, Illinois, Minnesota, Quebec, and Western Cape (South Africa); learning centers in over one hundred cities throughout North America; and several North American secondary school districts. In total, 15 central computers and over two thousand terminals are currently dedicated to PLATO use. A microcomputer version of PLATO has been developed and is currently being tested.

Microcomputers are by far the most widely used "systems" for CAI. Some, such as the SOL, have not survived into the 1980's. However, most of the major original microcomputers have survived into the 1980's and are now into their second or third generation of machine modifications.

Microcomputers have continued to decrease in cost while features, such as increasing memory space, have been improved. Peripherals and microelectronic boards are now available for most microcomputer systems which permit data storage and retrieval on floppy disks; use of several computer and authoring languages; interfacing with a printer; sound recognition and synthesis; use of color; generation of dynamic (animated) graphics; and the ability to create special characters.

This discussion of microcomputers and CAI would be incomplete and perhaps misleading, however, if mention at least were not made of microcomputers' significant limitations. The application and use of microcomputers in CAI currently has three major limitations: 1) lack of high quality, manufacturer produced courseware; 2) general inability to readily transfer material from one system to another; and 3) general inability to centrally collect and record individual student and class responses automatically for data analysis. These limitations have not been sufficiently addressed by educators.

There is a real danger that microcomputers will be purchased by schools and shortly, relegated to a cupboard for most of the time. The danger is especially acute where CAI is concerned: unless sufficient high quality programs are available, there is no possibility that a microcomputer can be used sufficiently to justify its cost. (Hallworth & Brebner, 1980, p. 115)

Perhaps the question for the 1980's is not whether CAI will be used, but whether it will be used wisely. As Braun (1980) has noted: "Computers will move into our homes and our schools whether or not anyone does anything to ensure their effective use" (p. 110).²

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References

- Atkinson, R. C. Computerized instruction and the learning process. *American Psychologist*, 1968, 23, 225-239.
- Atkinson, R. C., & Hansen, D. N. Computer-assisted instruction in initial reading: The Stanford project. *Reading Research Quarterly*, 1966, 2, 5-25.
- Bitzer, D. L., Braunfel, P. G., & Lichtenberger, W. W. PLATO II: A multiple-student, computer-controlled, automatic teaching device. In J. E. Coulson (Ed.), *Programmed learning and computer-based instruction*. New York: John Wiley & Sons, 1962.
- Bitzer, M. D., & Bitzer, D. L. Teaching nursing by computer: An evaluative study. *Computers in Biology and Medicine*, 1973, 3, 187-204.
- Braun, L. Computers in learning environments: An imperative for the 1980's. *Byte*, 1980, 5, 105-114.
- Dick, W. The development and current status of computer-based instruction. *American Educational Research Journal*, 1965, 2, 41-54.
- Hallworth, H. J., & Brebner, A. Computer assisted instruction in schools: Achievements, present developments and projections for the future. A Report Presented to Alberta Education, June 1980.
- Hicks, B. L., & Hunka, S. M. *The teacher and the computer*. Philadelphia: W. B. Saunders, 1972.
- Licklider, J. C. Preliminary experiments in computer-aided teaching. In J. E. Coulson (Ed.), *Programmed learning and computer based instruction*. New York: John Wiley & Sons, 1962.
- Lumsdaine, A. A. Teaching machines and self-instructional materials. *Audio-Visual Communication Review*, 1959, 7, 163-181.
- Merrill, M. D. Learner control in computer based learning. *Computers and Education*, 1980, 4, 77-95.
- Merrill, M. D., & Boutwell, R. C. Instructional development: Methodology and research. In F. Kerlinger (Ed.), *Review of Research in Education* (Vol. 1). Washington: AERA, 1973.
- Morrison, H. W., & Adams, E. N. Pilot study of a CAI laboratory in German. *Modern Language Journal*, 1968, 52, 279-287.
- Norris, W. C. Computer technology, education and the bottom line. *AEDS Monitor*, 1978.
- Pressey, S. L. A simple apparatus which gives tests and scores — and teaches. *School and Society*, 1926, 23, 373-376.
- Pressey, S. L. A machine for automatic teaching of drill material. *School and Society*, 1927, 25, 549-552.
- Pressey, S. L. A third and fourth contribution toward the coming "industrial revolution" in education. *School and Society*, 1932, 36, 668-672.
- Rath, G. J., Anderson, N. S., & Brainerd, R. C. The IBM research center teaching machine project. In E. H. Galanter (Ed.), *Automatic teaching: The state of the art*. New York: John Wiley & Sons, 1959.
- Reigeluth, C. M. TICCIT to the future: Advances in instructional design theory for CAI. *Journal of Computer-Based Instruction*, 1979, 6, 40-46.

- Schurdak, J. J. An approach to the use of computers in the instructional process and an evaluation. *American Educational Research Journal*, 1967, 4, 59-73.
- Skinner, B. F. The science of learning and the art of teaching. *Harvard Educational Review*, 1954, 24, 86-97.
- Skinner, B. F. Teaching machines. *Science*, 1958, 128, 969-977.
- Stolurow, L. M. Computer-based instruction: Psychological aspects and systems conception of instruction. *Journal of Educational Data Processing*, 1967, 4, 193-215.
- Suppes, P. The use of computers in education. *Scientific American*, 1966, 215, 207-220.
- Suppes, P., & Macken, E. The historical path from research and development to operational use of CAI. *Educational Technology*, 1978, 18, 9-12.
- Suppes, P., & Morningstar, M. Computer-assisted instruction. *Science*, 1969, 166, 343-350.
- Vacroux, A. G. Microcomputers. *Scientific American*, 1975, 232, 32-40.
- Wagner, F. V. Is decentralization inevitable? *Datamation*, 1976, 22, 86-97.

BOOK REVIEW

ED. PSYCH.: A CANADIAN PERSPECTIVE. By Alan Bowd, Daniel McDougall and Carolyn Yewchuk. Toronto: Gage Publishing, 1982, 470 pp.

This undergraduate textbook of educational psychology elicits a variety of emotional reactions - hope, disappointment, excitement, frustration and confusion. These feelings emerge and recede as the authors' unique contributions to the field are subverted by a fluctuating view of educational psychology. A shifting conceptualization from the traditional to the integrative, occurs as one progresses through the text. This lack of a consistent approach and the failure to present a truly Canadian perspective are not counterbalanced by a much needed and long overdue treatment of Bilingualism and Native education.

The title of the book offers a sense of hope that a Canadian perspective on educational psychology will be forthcoming. A number of educational psychologists have noted the difficulty of defining their discipline in terms of a unique perspective. That makes the attempt of Bowd, McDougall and Yewchuk to define a Canadian perspective a particularly ambitious undertaking. The excitement arising from anticipation of such a definition, however, is quickly diminished when one realizes that the objective of the text is to provide an "overview of psychology as it applies to basic concerns and issues in Canadian education in the 1980s" (p.10). This objective is attained by focusing on research conducted in Canada and making numerous references to Canadian scholars. Nevertheless, unlike ethnic and cultural studies, the research presented is not peculiar to Canada and hence, a new perspective to educational psychology is not to be unveiled.

The authors' ever-changing view of educational psychology is another major limitation of the text and for the most part leads to confusion. Initially, it is stated, "that psychology becomes *educational psychology* when its principles are applied to problems in education" (p.6). This traditionalist position is most apparent in the Development and Learning section (Part I) where education and psychology are seen as separate entities by the authors. A brief and cursory overview of learning theories, language development and motivation is presented. Educational implications arising from the theories of Piaget, Skinner and others are attached as seemingly mere appendages at the end of each chapter. The traditional position is maintained for the first 120 pages of the text; however, proponents of this approach are soon to be disappointed.

The integrative approach to educational psychology begins to appear in Part II: Socialization and Discipline. In their approach to this section the authors may have been influenced by the widely cited Scandura (1978) paper in which it was concluded that, in order for educational psychology to become a recognized discipline, "it must divorce itself from being just psychology applied to education" (p. 43). The section on Growing Up in Canada relates the family, school, and

other institutions to the socialization process. The integration of psychology and education is perhaps most fully developed in the chapter on Discipline. A synthesis of the theoretical framework, techniques, skills and examples of classroom management should prove useful to all educators, with special importance to beginning teachers.

Perhaps the most significant contribution of the text, and that which distinguishes it from others in the field, is its emphasis upon and treatment of the Needs of Special Groups of Children (Part III). This section closely approximates the renaissance approach to educational psychology advocated by Shapiro (1982), particularly in the chapters on Bilingualism and Native Education. For each topic the reader is provided with an historical and sociological context of the problems ethnic and Native students are faced with today. A multitude of strategies for effectively dealing with the "special child" in the classroom are related to the characteristics of cultural and linguistic differences of individuals and groups. In addition, a comprehensive overview of the nature of the Exceptional Child, as traditionally defined, is included. The studies, research, and examples presented in all three sections are relevant, pertinent, and related to education in the Canadian setting. This section should be an integral component of all teacher education programs in Canada.

The renaissance view of educational psychology which glimmered in Part II, and glowed in Part III, is gradually extinguished in Part IV. The reader experiences feelings of frustration as the traditional position reappears. The assessment of cognitive, affective, and psychomotor abilities is the focus of the Measurement and Evaluation section. Fundamental concepts such as test development, measurement, and taxonomies become the basis for discussions of educational issues related to teacher-observation, sociometry, and the evaluation of student performance. These chapters are of vital significance to the teacher, but the roller-coaster ride through the text, a function of the changing conceptualizations of educational psychology, detracts from the content.

Another limitation of the text is its failure to deal with the role of the teacher, or of educational psychology, in the future. The influence of a rapidly changing socio-politico-economic framework in the 1980s and 1990s will affect human behaviour, educational theory, and, therefore, the teacher. It could be argued that providing the reader with a consciousness of the future, of impending educational dilemmas, coping strategies and anticipated behavioural roles, is a responsibility that a text of this kind can no longer afford to ignore.

More positively, the text has some interesting features with respect to structure, style, and format. For instance, highlight sections, marginal summaries, directives for discussion, key terms, and concepts are included in each chapter. The use of Canadian research and writing provides an interesting dimension to otherwise familiar material. The authors write in an informal and easy-to-read style which should be attractive to most undergraduate students in Education.

In summary, the lack of conceptual consistency is a major weakness of the text. Moreover, the choice of a somewhat presumptuous title creates false expectations, leaving the reader with a sense of disappointment. Although the role of teacher in the future is noticeably absent, the text does make a significant contribution by virtue of its treatment of Bilingualism and Native Education. Unfortunately, in the final analysis the strengths of the text do not offset the weaknesses.

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References

- Scandura, J. M. Current status and future directions of educational psychology as a discipline. *Educational Psychologist*, 1978, 13, 43-56.
- Shapiro, B. J. The Renaissance educational psychologist. Paper presented at the Canadian Society for the Study of Education conference, Ottawa, June, 1982.

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The Influence of Teachers' Tolerances
for Specific Kinds of Behaviors
on Their Ratings of a Third Grade Student

Behavior problems result from the complex interaction of child characteristics and adult beliefs and expectations. In this research, ratings of a third grade student were differentially effected by the tolerance of the rates for the primary behaviors exhibited by the pupil. Approximately 120 regular classroom teachers were asked to read a case study and respond to 13 questions about the student in it. Ratings of an immature child were influenced by teacher tolerances while rating of an unmanageable student were not; the unmanageable student was rated more negatively overall. The concept of the 'ideal' student is presented in discussion of the results and their implications.

School-related behavior problems have always been prevalent in America's schools (Sarason & Doris, 1979), and a variety of explanations have been set forth for the origins of these problems (Quay, 1973; Ysseldyke & Algozzine, 1982a). Academic and behavior problems may be viewed as the direct result of experiential action among these factors (Quay, 1973). From an ecological perspective, behavior is not problematic, deviant, or abnormal in and of itself; a

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behavior is considered a problem as a function of the time it occurs, the place it occurs, the person who exhibits the behavior, and the person who sees it (a socially sanctioned labeler) (Ullman & Krasner, 1969). In school settings, the same behavior may be regarded as normal or abnormal as a function of the time and place in which it occurs; most importantly, problems are a function of the teacher or other school personnel who observe the behavior and their tolerance for it.

Rubin and Balow (1978) reported the results of a longitudinal investigation of 1,586 students, and indicated the following:

[The] most striking finding of this study was the high percentage of children who were identified as exhibiting behavior problems by at least one teacher during the course of their elementary school careers. More than half (58.6 percent) of all subjects who received three or more teacher ratings were classified as a behavior problem at least once. Among students who received six teacher ratings, 60 percent (68 percent of the boys and 51 percent of the girls) were considered a behavior problem by at least one teacher. (p. 109)

Current rates of referral for psychoeducational evaluation are extremely high. Algozzine, Ysseldyke and Christenson (1982) report that nationally, four to six percent of the public school population is being referred for psychoeducational evaluation each year. Christenson, Algozzine, and Ysseldyke (1982) report that 92% of referred students are tested, while 73% of referred students are declared eligible for special education services. Clearly, problems in school are common for many of America's children.

Teachers' views of the causes for students' "problems" are interesting. In 1979, the research staff of the National Education Association (NEA) surveyed teachers to ascertain their perceptions of why students do poorly in school. They found that 81% of teachers placed the blame for school difficulties on students' home and family life, 14% blamed the students themselves; only 1% blamed inadequate instruction, while 4% attributed problems to the ways in which schools were organized. Clearly, the behaviors that students exhibit cause teachers to take a variety of actions with them, and the decisions made by teachers influence the lives and life opportunities of students.

Two recent investigations have reported an interaction between the kinds of behaviors that students evidence and teachers' tolerance for those behaviors in influencing the decisions made and actions taken with students. Curran and Algozzine (1980) found that decisions related to mainstreaming were influenced by teachers' opinions about demonstrated classroom behaviors. Ysseldyke and Algozzine (1981) found that the most influential piece of information in a simulation of psychoeducational decision making was student behavior at the time of referral.

In this investigation we examined the extent to which teacher decisions about a student were influenced by the student's characteristics in interaction with the teachers' stated tolerance for those characteristics. Ratings of case studies for an immature or unmanageable student were compared for teachers with differing levels of tolerance for those same behaviors.

Method

Subjects

Elementary school teachers ($n=116$) participated in the study; 92 percent of the teachers worked in public school classrooms. The sample was comprised

mostly of females (84%) from urban or suburban schools (70%) with school populations below 15,000 students (68%). Between 2 and 11 teachers were included from each grade represented (i.e., 1-7). The participants were well-educated; all had bachelor's degrees and many had master's degrees as well.

TABLE 1
DEMOGRAPHIC DATA FOR PARTICIPATING TEACHERS

Variable	Sample One	Sample Two
<u>Teacher Sex</u>		
Male	16	15
Female	84	85
<u>Teacher Age</u>		
Under 25	9	0
25 - 34	28	39
35 - 44	34	32
45 - 54	12	24
55 - 64	16	5
<u>Years of Teaching Experience</u>		
Less than 1 year	5	
1 - 2 years	5	
3 - 5 years	16	5
6 - 9 years	20	17
10 - 15 years	18	46
More than 16 years	36	32
<u>Type of School</u>		
Public	90	93
Private	10	7
<u>School Location</u>		
Urban	27	44
Suburban	44	24
Rural	29	32
<u>School Population</u>		
Below 3000	36	30
3000 - 6999	14	20
7000 - 9999	13	7
10000 - 14999	7	5
15000 - 24999	4	11
25000 - 49999	9	5
50000 - 74999	7	9
Over 75,000	10	13
<u>Grade Level Taught</u>		
First	18	17
Second	12	19
Third	18	17
Fourth	20	14
Fifth	9	17
Sixth	9	4
Seventh	14	12

Note. N = 57 and 59 teachers in Sample One and Two respectively; numbers reflect percentages of each sample.

Approximately half of the teachers (i.e., 57) were randomly assigned to read a case study describing a child with immature behavior; others (i.e., 59) received a description of an unmanageable student. The demographic data for both samples are presented in Table 1.

Procedures

The teachers were randomly selected from a national list of regular education teachers which was purchased from Market Data Retrieval. Each teacher was sent an initial letter explaining the study and offering payment for participation. Upon receipt of a signature indicating willingness to be included in the sample, each teacher was sent a case study and short questionnaire. A demographic survey form and *Disturbing Behavior Checklist II* (Algozzine, 1979) was sent subsequent to receipt of the initial materials; contracts arranging for payment were also included in the second set of materials. A two-week time limit was suggested for completion of each part of the study; however, follow-up letters and postcards were used to encourage the return of completed materials. The experiment, then, consisted of two stages: teachers first reacted to a child presented to them in a brief case study, they next provided their reactions to a set of behavioral descriptions. Tolerance for the behavioral descriptors was used to define groups of teachers whose ratings of the case study child were compared.

Case Studies. Two different summaries describing a third grade boy were prepared; a student demonstrating *socially immature* behaviors was described in one and a student exhibiting unmanageable behaviors was described in the other. The case studies were consistent in format. Each contained sections of similar information in these areas: medical, developmental, family, school history, test information, and third grade classroom observations. Assessment information was within the average range for a student of similar age and grade. Different behaviors were included to portray the *immature* or *unmanageable* student. For example, *limited expressive ability*, *very shy*, *insecure*, and *delayed age-appropriate social skills* were checked as concerns the case study of the *immature* child; other items of a similar nature were interspersed within the case study narrative. Different behaviors (e.g., *rude*, *defiant*, *lack motivation*) were "concerns" included in the narrative for the *unmanageable* student. It is important to note that except for the inclusion of these behavioral phrases, the case studies portrayed a rather ordinary child.

Dependent Questionnaire. After reviewing the case summary, teachers' ratings of the child were obtained by means of a short questionnaire. Specifically, teachers were asked to answer the following questions:

1. To what extent do you think David has a behavior problem?
2. To what extent do you think David has a learning problem?
3. To what extent do you think David is eligible for Special Education Services?

Responses were collected on a 1 (very unlikely) to 5 (very likely) scale. Teachers were also asked to make predictions about David's school performance (1 = deficient/poor, 5 = superior/excellent) in 10 areas: academic achievement, visual and/or auditory perception, memory skills, fine and/or gross motor performance, attending behaviors, completion of assignments, social acceptance, ability to follow directions, acceptance of responsibility and self-concept. Scores on these items were compared.

Independent Variable. After completing the initial activity, teachers were asked to supply demographic information and rate the extent to which certain behaviors bothered them. The *Disturbing Behavior Checklist II* (DBC-II) was the measure of teacher tolerance for different types of behavior. The DBC-II contains 51 items derived from case folders of students classified as learning disabled (LD) or from LD textbooks (Algozzine, 1979); each item is rated on a 1 (not very disturbing) to 5 (very disturbing) scale. Sutherland, Algozzine, Foster and Wall (1980) identified three factors within the DBC-II; behaviors which were bothersome to teachers were contained in each. The first factor of disturbing items (i.e., general perceptual problems) included problems such as written reversals, poor word attack skills and being unable to blend sounds. Unmanageable behaviors (i.e., Factor 2), such as rudeness, impulsivity, irritability and hyperactivity, and immature behaviors (i.e., Factor 3), such as insecurity, anxiety, and inadequate self-concept were also found to be disturbing to teachers. In this research, average scores on the immature and unmanageable behavior factors of the DBC-II were used to group teachers into those with more or less tolerance for the specific behaviors in the factors.

Teachers receiving the case summary for an immature or unmanageable student were subdivided into two additional groups each. Those with ratings greater than the sample mean on Factor 3 (i.e., immaturity) on the DBC who received the case study describing an immature student were compared to teachers whose ratings were below the mean on that factor. Similarly, the teachers who received the unmanageable student's case study summary were divided according to their responses to the items comprising Factor 2 (i.e., unmanageable behaviors) of the DBC-II. In this way, the effects of teacher tolerances for behaviors on their ratings of a student exhibiting those same behaviors were evaluated.

Data Analysis

Two sets of *t*-tests were completed. High and low tolerance groups were compared on 13 different responses about a student exhibiting immature or unmanageable behaviors. Because of the large number of tests, two stringent criteria were set for significance testing; the 0.01 *alpha* level was used for statistical tests and a 0.5 unit difference between means was applied in an attempt to separate trivial findings from important ones.

Results

Teachers were requested to rate the extent to which the case study student had a behavior problem, a learning problem, and was eligible for special education services; similarly, predictions in 10 areas of school-related functioning were solicited. Comparisons of ratings made by teachers more tolerant of immature behavior and those less tolerant of the same behavior were completed. No differences were indicated in the teachers' ratings of the immature student's current problems (i.e., academic or behavior) or eligibility for special education (see Table 2); however, it should be noted that less tolerant teachers ratings were less favorable in each case than those of tolerant teachers. Significant differences were indicated in teachers' predictions of the future classroom and interpersonal behaviors of the immature student. Tolerant teachers ($n=27$) rated 9 of the 10 prediction areas higher than the intolerant teachers ($n=29$). Predictions for

academic achievement, memory skills, and motor performance were higher for tolerant teachers; similarly, attending behaviors, completion of assignments, and ability to follow directions were more highly rated by teachers who were more tolerant of immature behavior. Interpersonal skills such as social acceptance, self-concept, and acceptance of responsibility were also rated differently by tolerant and intolerant teachers. Means and standard deviations for teachers' predictions for a student exhibiting immature behavior are presented in Table 3.

TABLE 2

MEANS AND STANDARD DEVIATIONS FOR TEACHERS' JUDGMENTS OF IMMATURE STUDENT'S CURRENT BEHAVIOR

Judgment	Group			
	Tolerant		Intolerant	
	\bar{X}	SD	\bar{X}	SD
To what extent do you think David has a behavior problem?	2.9	(1.4)	3.2	(1.5)
To what extent do you think David has a learning problem?	3.4	(1.1)	3.8	(1.0)
To what extent do you think David is eligible for special education services?	3.0	(1.3)	3.5	(1.2)

Note: 1 = Very Unlikely 5 = Very Likely

TABLE 3

MEANS AND STANDARD DEVIATIONS FOR TEACHERS' PREDICTIONS FOR STUDENT EXHIBITING IMMATURE BEHAVIOR

Prediction Area	Group			
	Tolerant		Not Tolerant	
	\bar{X}	SD	\bar{X}	SD
Academic Achievement	2.8	(0.7)	2.2	(0.8)*
Visual and/or Auditory Perception	3.0	(0.6)	2.6	(0.9)*
Memory Skills	2.9	(0.8)	2.3	(0.7)*
Fine and/or Gross Motor Performance	2.9	(0.8)	2.4	(0.8)*
Attending Behaviors	3.0	(0.8)	2.3	(1.0)*
Completion of Assignments	3.1	(1.0)	2.3	(1.1)*
Social Acceptance	2.9	(0.9)	2.2	(0.9)*
Ability to Follow Directions	3.1	(0.9)	2.5	(1.0)*
Acceptance of Responsibility	3.1	(0.9)	2.5	(1.0)*
Self-Concept	3.2	(1.2)	2.5	(1.3)*

Note: 1 = deficient or poor 5 = superior or excellent. * $p < .01$

No differences were indicated for ratings of the unmanageable student (see Table 4). Teachers with different levels of tolerance rated a student exhibiting unmanageable behavior similarly. It should be noted, however, that the judgments about this student were more negative than those made about the immature child. For example, special education eligibility was more likely ($\bar{x} = 3.85$) for the unmanageable student than the student exhibiting immature behaviors ($\bar{x} = 3.25$), a similar pattern was evident in other ratings as well. This suggests that the unmanageable student is more likely to be viewed as a problem regardless of one's tolerance for behavior which is exhibited and that different reactions may result in teachers faced with an "immature" student.

TABLE 4
MEANS AND STANDARD DEVIATIONS FOR TEACHERS'
RATINGS OF THE UNMANAGEABLE STUDENT

Teacher Ratings	Group			
	Tolerant		Not Tolerant	
	\bar{X}	SD	\bar{X}	SD
<u>Judgment</u>				
Behavior Problem	4.7	(0.5)	4.6	(0.9)
Learning Problem	3.4	(1.1)	3.8	(1.1)
Special Education Services	3.8	(1.2)	3.9	(1.1)
<u>Prediction</u>				
Academic Achievement	2.0	(0.8)	2.2	(0.9)
Visual and/or Auditory Perception	3.1	(0.8)	3.0	(0.8)
Memory Skills	2.7	(0.9)	2.7	(1.0)
Fine and/or Gross Motor Performance	3.0	(0.7)	3.0	(0.9)
Attending Behaviors	2.1	(1.0)	1.9	(0.9)
Completion of Assignments	2.3	(1.1)	2.2	(1.2)
Social Acceptance	2.3	(1.1)	2.0	(1.1)
Ability to Follow Directions	2.4	(0.9)	2.1	(0.9)
Acceptance of Responsibility	2.4	(0.9)	2.0	(1.1)
Self-Concept	2.6	(1.2)	2.2	(1.3)

Note: 1 = deficient or poor 5 = superior or excellent

Discussion

Mixed results were obtained in this investigation of the extent to which teachers' tolerances for different kinds of behaviors influenced their perceptions of students who evidenced those behaviors. Consistently, teachers' tolerances for specific kinds of behaviors did not significantly influence the extent to which they saw students who exhibited those behaviors as having learning problems or behavior problems, or as being eligible for special education. However, teachers did have different prognoses for students who exhibited immature behaviors, and their prognoses were a direct function of their tolerance for those behaviors. Teachers who were not bothered by immature behavior held higher expectations for a student who evidenced immature behavior; however, no differences were indicated in ratings of the unmanageable student by teachers with different

tolerance for exhibited behaviors. Overall, a student with unmanageable behaviors was viewed less favorably than one with immature behaviors.

In discussing the relation between "teachers' perceptions and educational decisions," Kornblau and Keogh (1980) indicated that:

The complexities of teacher-pupil interaction have long interested educational researchers, yet it seems fair to say that the nature of the functional "match" between pupil and teacher remains uncertain. Fortunately, in most classrooms both child and teacher can tolerate considerable discrepancy from an ideal match. In the case of exceptional children, however, the match may be especially important, since they may be less able to tolerate incompatibilities with teachers' expectations and styles. It is interesting to note that the historical and still common response to pupils who "don't fit" in the regular educational program is to exclude them. Current legislation, however, has mandated the inclusion of exceptional children into regular programs wherever feasible. Consideration of teacher-pupil interaction thus becomes practical and urgent. (p. 87)

It is interesting to note their concern for the child's limited tolerance in appropriate educational "matches."

In 1970, Rist suggested that teachers' views of "ideal" students influence perceptions and evaluations of actual students. Recently, Kornblau (1979) identified three dimensions of behaviors which characterized "ideal, teachable" students; she labeled them: cognitive-motivational behaviors, school appropriate behaviors, and personal social behaviors. Behaviors which characterize "ideal" students are *not* included on the disturbing behavior checklists.

Student behaviors are a function of a complex set of interactions; to a large degree, problems are thought to originate in the life experiences of the *child* (cf. National Education Association, 1979; Quay, 1973). Kornblau and Keogh (1980) indicate that "understanding pupils' progress in school also involves consideration of the teachers' perceptions and expectations" (pp. 98-99). They also suggest that teachers' expectations for individual students are "in part influenced by their values of the characteristics of a model ideal pupil, and that discrepancies from this model affect the formation of self-generated expectations" (p. 99).

In this research, less than "ideal" characteristics were manipulated in case studies and evaluated by regular education teachers; in part, evaluations were influenced by tolerance for the characteristics. The results have implications for diagnostic and prescriptive practice. Simply evaluating the psychoeducational characteristics of the *child* appears to be a limited diagnostic practice; clearly, the child's teacher is an important factor in any referral for evaluation. Similarly, since the child is only part of an educational dyad, planning instructional intervention without concern for teacher tolerances and/or expectations for differing types of students may result in limited educational outcomes. As Kornblau and Keogh (1980) indicate, "[i]t is not realistic to expect teachers to work equally effectively with all pupils; but it is realistic to expect teachers to be sensitive to their own perceptions of their pupils" (p. 99). In this work, we found that a group of teachers with different degrees of sensitivity (we called it tolerance) reacted differently to a student exhibiting behaviors to which sensitivity varied. The extent to which similar outcomes would be present in a naturalistic classroom environment was not addressed; however, the results obtained in this work are initial evidence that such additional research would provide fruitful data for diagnostic-prescriptive planning.

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References

- Algozzine, B. *The disturbing child: A validation study*. Minneapolis: Institute for Research on Learning Disabilities, 1979 (Research Report #8).
- Algozzine, B., Ysseldyke, J., & Christenson, S. An analysis of the rate of referral for and placement in special education classes. Manuscript submitted for publication, 1982.
- Christenson, S., Algozzine, B., & Ysseldyke, J. E. Probabilities associated with the referral to placement process. *Teacher Education and Special Education*, 1982, 5(3), 19-23.
- Curran, T. J., & Algozzine, B. Ecological disturbance: A test of the matching hypothesis. *Behavioral Disorders*, 1980, 5, 169-174.
- Kornblau, B. W., & Keogh, B. K. Teachers' perceptions and educational decisions. *New Directions for Exceptional Children*, 1980, 1, 87-101.
- National Education Association. Teacher opinion poll. *Today's Education*, 1979, 68, 10.
- Quay, H. C. Special education: Assumptions, techniques, and evaluative criteria. *Exceptional Children*, 1973, 40, 165-170.
- Rist, R. Student social class and teacher expectations: The self-fulfilling prophecy in ghetto education. *Harvard Educational Review*, 1970, 40, 414-451.
- Rubin, R. A., & Balow, B. Prevalence of teacher identified behavior problems: A longitudinal study. *Exceptional Children*, 1978, 44, 102-111.
- Sarason, S. B., & Doris, J. *Educational handicap, public policy and social history*. New York: Free Press, 1979.
- Sutherland, J., Algozzine, B., Foster, G., & Wall, C. The LD child: An ecological problem? *Diagnostique*, 1979, 4, 52-59.
- Ullman, L., & Krasner, L. *A socio-psychological approach to abnormal behavior*. Englewood Cliffs, NJ: Prentice-Hall, 1969.
- Ysseldyke, J. E., & Algozzine, B. *Critical issues in special and remedial education*. Boston: Houghton-Mifflin, 1982. (a)
- Ysseldyke, J. E., & Algozzine, B. Diagnostic classification decisions as a function of referral information. *Journal of Special Education*, 1981, 15(4), 429-435.

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Comprehension Categorical Differences and Unit of Language Analysis

Content analysis is an important methodological procedure in educational research. Its use necessitates two important decisions: the unit of analysis and the category system for coding the data. A number of studies have been completed using a system of comprehension categories for recall analysis. However, the unit of analysis has varied among studies. This study investigated the influence of using each of three units of analysis (t-unit/incomplete t-unit, clause, and syntactic proposition) on the assignment of data to the comprehension categories. There were significant correlations between corresponding categories for the t-unit/incomplete t-unit and clause which suggests that the use of either of those units gives similar results. The use of the syntactic proposition will result in a different profile in terms of the amount of information assigned to the comprehension recall categories.

Content analysis is a recognized methodological procedure in educational research. Content analysis allows the researcher to describe the content of various situations, particularly language situations. In order to apply this methodological procedure, two key decisions which must be made concern the *unit of analysis* and the *system of categories* to which these units are to be assigned. It is possible that a different category profile may result depending on the unit chosen for the initial analysis of the data.

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Discourse Analysis

Although as early as 1932, Bartlett focussed on analysis at the discourse level in experiments on remembering, it was not until the 1970's, in what appeared to be a backlash against transformational grammar and its focus on the sentence as the unit of meaning, that discourse analysis received its great impetus.

Analysis of Recall Data

In the Bartlett tradition, many researchers concerned themselves with analysing the recalls of subjects in response to a particular text. Even though they varied somewhat in their views about the relationships of recalls to text input, in order to conduct an analysis of the recalls it was necessary to devise a structural description of the text. The resulting descriptions often differed in the emphasis placed on various structural elements. Grimes (1972), for example, believed that connected discourse should be studied at three levels — content, cohesion, and staging of the information in the text. The content was mainly comprised of semantic information such as role relations (e.g., agent), while cohesion focussed on the structural relations of text elements via a referential system (e.g., pronominalization). The final component, staging, referred to the positioning of information which allowed the speaker to select certain pieces of information for greater focus. Frederiksen's (1975) model of discourse structure was more complex than Grimes' but there were similarities. For example, the semantic structure included a dependency system (consisting of a logical and a causal system) and was similar to Grimes' cohesion component. A system devised by Drum (1974) focussed exclusively on inter-sentence dependence, and she specified a number of logical and referential connectives by which sentences are related.

Researchers such as Meyer and McConkie (1973), Meyer (1975,1977), Kintsch (1972,1974) and van Dijk and Kintsch (1976) concerned themselves with the "importance" of elements within the text structure and the hierarchical relationships of these elements, while another group of researchers focussed on one particular form of text — the narrative (Rumelhart, 1976; Mandler & Johnson, 1977; Thorndyke, 1977; Stein & Glenn, 1978). Their structural descriptions of stories were designed to predict which story components (setting, goal, etc.) would be best remembered.

Drum and Lantaff (1977) devised a system of categories for protocol analysis which was designed to assess the kinds of information that subjects retained after reading a text. These categories were further refined by Fagan (in press) and were subsequently used in a number of research studies (Zinn, 1979; Beebe, 1981; Brake, 1981; Clarke, 1981; Machura, 1981).

Unit of Analysis

Regardless of the structural description, a particular unit of analysis must be chosen in order to determine the similarities between the recall protocol and the text. In many cases the protocols were analysed for the presence of elements specified within the text structure (e.g., goal in story grammar, referential connectives in relational information systems). The semantic proposition was defined as a unit comprising at least two concepts — one expressing a relation and one or more designating an argument. A very detailed system of utilizing the proposition was developed by Turner and Greene (1977) for constructing a text

base which supposedly was an idealized account of the semantic information conveyed by means of a particular discourse. The syntactic proposition originated with Fagan (1978) and was similar to the semantic proposition except that it was identified on the basis of semantic *and syntactic* criteria.

Other units used in text analysis originated for the purpose of describing oral or written language (independent of recall). Most common among these units are the communication unit (Loban, 1976), the t-unit (Hunt, 1965), the incomplete t-unit (Fagan, 1978), and grammatical elements from traditional or structural grammar, such as the clause (Strickland, 1962).

The t-unit, incomplete t-unit, syntactic proposition, and clause have all been used in the studies that have used Fagan's system of recall categories. The question that needed to be answered was, "Does the profile obtained by using the comprehension category system differ according to the unit of analysis used?"

The t-unit/Incomplete t-unit.

The t-unit was initially devised by Hunt (1965) and was similar to Loban's (1976) communication unit. Whereas the communication unit need not be structurally intact (e.g., the response "yes" to the question, "Will you be at the hockey game?"), the t-unit had to have all syntactic elements specified. It was defined as containing a main clause and any subordinate clauses attached. Fagan (1978) questioned the logic and feasibility of eliminating language data which did not fit into t-units since speakers often utter sequences of words that are not grammatically intact in the sense of having a finite subject and a finite verb. Consequently, Fagan (1978) devised the "incomplete t-unit" to account for the language data that would not fit the t-unit description. An incomplete t-unit was considered equivalent to a t-unit in terms of the semantic value it could carry; its key difference was that it was not syntactically intact as a main clause (and a subordinate clause) but lacked either the specified subject, a verb, or necessary complement. The conversation example below has been divided into t-units and incomplete t-units (latter in italics).

Jim: Don't forget that we meet at Mrs. Smith's house at eight tonight. *Auditions for the school play.*

Bob: Is that the big stucco house on Elm Street?

Jim: *No, across from Pine Park on Second.*

Bob: Can you give me a ride?

Jim: *7:45 at your place.*

The first, "Auditions for the school play," lacks a finite verb. To make it a complete clause (syntactically) it would have to read "Auditions for the school play will be held" or "She will be holding auditions for the school play," etc. However, in its present form it cannot be ignored semantically for it still carries approximately the same semantic meaning as if it had been stated in complete syntactic form.

The Clause

A clause is defined as a unit of language that contains a finite subject and a finite verb. A clause may be either main or subordinate. There are two clauses in the t-unit, "(You) *don't forget/that we meet* at Mrs. Smith's house at eight tonight." (Subjects and verbs are in italics).

The Syntactic Proposition

It was Fagan's (1978) contention that since all semantic ideas are expressed in syntactic form it should be possible to start with the syntactic forms and infer the semantic content. Accordingly he identified 20-22 such syntactic units. The units were of two types, base and alternate. A base unit was the simplest syntactic form in which a semantic idea could be expressed. Examples were "The dog barks," "The child is swimming." An alternate unit was attached to a base unit and with the addition or substitution of words could be written as a base unit. For example, the alternate syntactic unit (in italics) in the sentence, "Is that the big¹ stucco house *on Elm Street*" can be rewritten as "The big stucco house is on Elm Street."

Comprehension Categories

Five major categories have been identified and are defined below. Specific criteria for allocating recall data to each of these categories may be found in Fagan, in press; Clarke, 1981; and Kavanagh, 1981.

Category A: Text Exact. This category includes information from the text in its exact form or with minimal variations.

Category B: Text Specific. This category includes information recalled that had specific references in the text. The reader may have "transformed" some of this information by reordering or substituting lexical items.

Category C: Text Entailed. This category includes information which is retrieved as (a) a paraphrase of or synonymous with the information input, but the unit of recall includes information from more than one unit of input, or (b) a subordinate statement subsuming information from more than one text unit.

Category D: Text Experiential. This category includes information added by the reader to fill in gaps in the text data.

Category E: Text Erroneous. This category includes information which the reader has processed incorrectly, either at the time of comprehending or at production of the recall.

Related Research Studies

Clarke (1981) and Brake (1981) were interested in recall differences between high and low reading achievers. Clarke investigated the oral reading of a sample at the grade four level while Brake worked with grade two subjects and examined their performance in oral and silent reading. Neither researcher found differences between reading groups. Brake, however, found that the subjects recalled more text specific information when reading orally and more text erroneous information when they read silently. Whereas Clarke used the *clause* as the unit of analysis, the amount of information in Brake's categories was based on the *t-unit/incomplete t-units*.

Beebe (1981), like Clarke, worked with grade four subjects, and divided their recalls on the basis of the *clause* unit. She found that the best predictor of comprehension was the use of integrated and synthesized information. As would be expected, the use of erroneous information was a significant indicator of low reading comprehension.

Zinn (1979), and Machura (1981) were interested in the relationship of the subjects' recalls and the number/nature of connectives involved. Both used high

and low reading achievers at the grade four level in their sample, but whereas Zinn used the t-unit/incomplete t-unit as her unit of analysis, Machura divided her protocols on the basis of the *clause*. Zinn found that when subjects read a passage with the logical connective “because” present, the low reading group produced more recall data that was classified as text external (drawn from the readers’ experiences). When passages without this causal connective were read, more specific text information was recalled by the low reading group and more integrated information by the high reading group. Machura (1981), who concentrated on passages with greater and fewer numbers of perceptual connectives of time and space, found that whereas high and low reading achievers did not differ in the nature of the information recalled (as assigned to comprehension categories), readers did produce more perceptual connectives in their recalls if they were present in the input passages.

Design

Sixteen recall protocols were analysed according to three different language units and were then assigned to one of five comprehension categories. Pearson Product Moment correlations were computed to determine the agreement of assignment to categories across units.

Sample²

Sixteen grade six students, who were reading at least at a grade five level according to a standardized reading test, were chosen. The subjects were Cree or Metis, that is they had been brought up in homes where Cree was spoken, and their parents, at least, actively conversed in this language. The official definition of Metis was also used as a guideline, that is, they should have at least a quarter Native blood. Of 20 students who met this criterion, 16 were chosen from 17 volunteers.

Passage

The story used is a popular European fairytale “The Elves and the Shoemaker” from *Grimm’s Tales*. The story was rewritten so that it corresponded to the Mandler and Johnson (1977) grammar for a canonical story. The story contained 54 t-units/incomplete t-units, 81 clauses, and 157 syntactic propositions.

Procedures

Testing was done individually and the subjects were given the following directions:

I am interested in how children remember stories. I want you to read this story. Make sure that you have understood it well. Later you will be asked to tell it again as exactly as you can.

Following a five minute break in which the subject was engaged in giving the researcher some background information, discussing home and school activities, and examining some objects brought by the researcher, the student was asked to recall the story. The instructions were as follows:

Now would you tell me the story that you read. Try to remember as much of it as possible.

When it appeared that subjects were finished with the recall, they were asked if there was anything else. The recalls were recorded and later transcribed for analysis.

Analysis

The sixteen protocols were analysed separately into each of the language units and then assigned to the comprehension categories. The first analysis was in t-units/incomplete units; the second analysis was in terms of clauses and the third in terms of syntactic units. The interrater reliability (using two independent raters) for each of the analysis is given in Table 1.

TABLE 1
INTERRATER RELIABILITY FOR UNITS OF ANALYSIS
AND ASSIGNMENT TO CATEGORIES

	Percent Agreement
T-unit/incomplete t-unit	98.7
Clause	99.8
Syntactic Proposition	90.3
Comprehension Categories	97.6

Findings

Means and Standard Deviations

The means and standard deviations for each category on the basis of each unit of analysis are given in Table 2.

TABLE 2
MEANS AND STANDARD DEVIATIONS FOR PERCENT
OF RECALL ASSIGNED TO COMPREHENSION CATEGORIES
ON THE BASIS OF THREE UNITS OF ANALYSIS

Category		T-unit/ Incomplete t-unit	Clause	Syntactic Proposition
A	\bar{X}	2.59	2.78	4.35
	SD	2.40	2.83	3.70
B	\bar{X}	53.44	58.39	41.34
	SD	7.73	6.17	6.04
C	\bar{X}	18.42	13.82	32.20
	SD	7.31	6.38	9.63
D	\bar{X}	23.07	23.24	19.62
	SD	9.60	9.54	6.85
E	\bar{X}	2.49	2.75	3.06
	SD	2.88	2.41	2.62

The data on this table show that most of the information recalled fell into the Text Specific category while the least amount was either Text Exact or Erroneous. The means of these two categories was usually very close.

An analysis of the types of text information recalled relative to one another is more similar for the data assigned on the basis of the t-unit/incomplete t-unit and the clause. The profiles of the data recalled by category are graphed in Figure 2. This graph shows that whereas most recall information was assigned to Category B on the basis of all three units, the height of the graphs for this category was closer for the first two units. The means for Categories A and E also follow the same relative order but the means for these two categories are higher when information is assigned to categories on the basis of the syntactic proposition than when assigned on the basis of the other two units. The most noticeable change occurs when information is assigned to Category C and D. The relative weight of these means are in the opposite direction for the syntactic proposition when compared to the other two units. However, the mean for the D Category is relatively similar across units. Standard deviations are relatively consistent across units which would seem to indicate that the dispersion among subjects in terms of the data recalled is similar regardless of the unit chosen for assignment to categories.

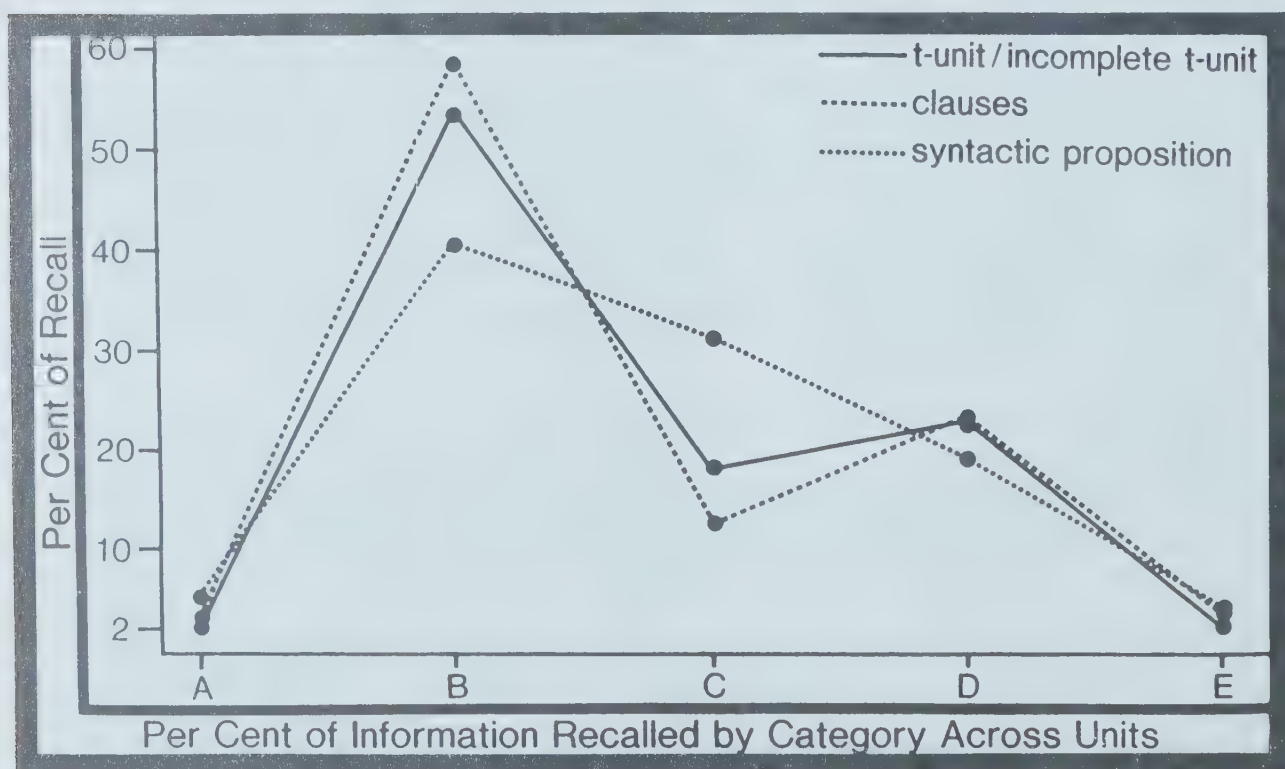


Figure 1.

Correlations

Table 3 provides a summary of the correlations between categories together with their levels of significance. An analysis of the data on this table shows that correlations between all categories based on the t-unit/incomplete t-unit and clause are significant beyond the .001 level. When categories are compared on the basis of t-unit/incomplete t-units and syntactic propositions, agreement between

three of the categories (B, C, E) fails to reach significance ($p < .05$). A similar comparison for the clause and syntactic proposition units reveal a lack of significant agreement between two of the categories (B, E).

TABLE 3
CORRELATIONS BETWEEN CATEGORIES OF COMPREHENSION
BASED ON THREE UNITS OF ANALYSIS

A1/A2	.935(.00)	A1/A3	.604(.01)	A2/A3	.664(.01)
B1/B2	.871(.00)	B1/B3	.142(NS)	B2/B3	.189(NS)
C1/C2	.814(.00)	C1/C3	.466(.06)	C2/C3	.623(.01)
D1/D2	.928(.00)	D1/D3	.737(.00)	D2/D3	.822(.00)
E1/E2	.863(.00)	E1/E3	.193(NS)	E2/E3	.441(NS)

Note: 1 = t-unit/incomplete t-unit
2 = clause
3 = syntactic proposition

In summary it appears that the use of either the t-unit/incomplete t-unit or the clause as units of language analysis will result in similar mean and standard deviation sizes and a high degree of consistency in terms of the profile obtained when the units are assigned to a system of comprehension categories. The use of the syntactic proposition will give a slightly different profile.

A Profile of a Single Subject

The data for one subject chosen at random were graphed in order to demonstrate more clearly the implications of using different units of analysis for describing the comprehension recalls of readers. The data are presented in Figure 2. Consistent with the means of the group, there is little difference between the profiles obtained when information is assigned to comprehension categories on the basis of the t-unit/incomplete t-unit, and the clause. A different profile is produced when the syntactic proposition is used. Several differences may be noted. Consistent with expectation, there was more information assigned to Text Exact and less assigned to Text Erroneous than when the other two units of analysis were used. It is more likely that readers will remember smaller units in their exact form since there would be less stress on the capacity of rote memory. Similarly, it is less unlikely that readers will confuse smaller units of information as opposed to larger segments of the text. The other two categories where noticeable differences occurred were C (Text Entailed) and D (Text Experimental). The percentage of recall assigned to these was higher for C and lower for D than when recall was assigned on the basis of the other two units.

Discussion

The profiles obtained when recall information was assigned to comprehension categories on the basis of the t-unit/incomplete t-unit and the clause were more similar than when information was assigned on the basis of the syntactic

proposition. It was possible that the number of t-units/incomplete t-units in the recalls and the number of clauses were approximately equal. However a check showed that there were 502 t-units/incomplete t-units compared to 615 clauses. Consequently it seems that if either of these units were chosen for analysing recall data will produce similar results.

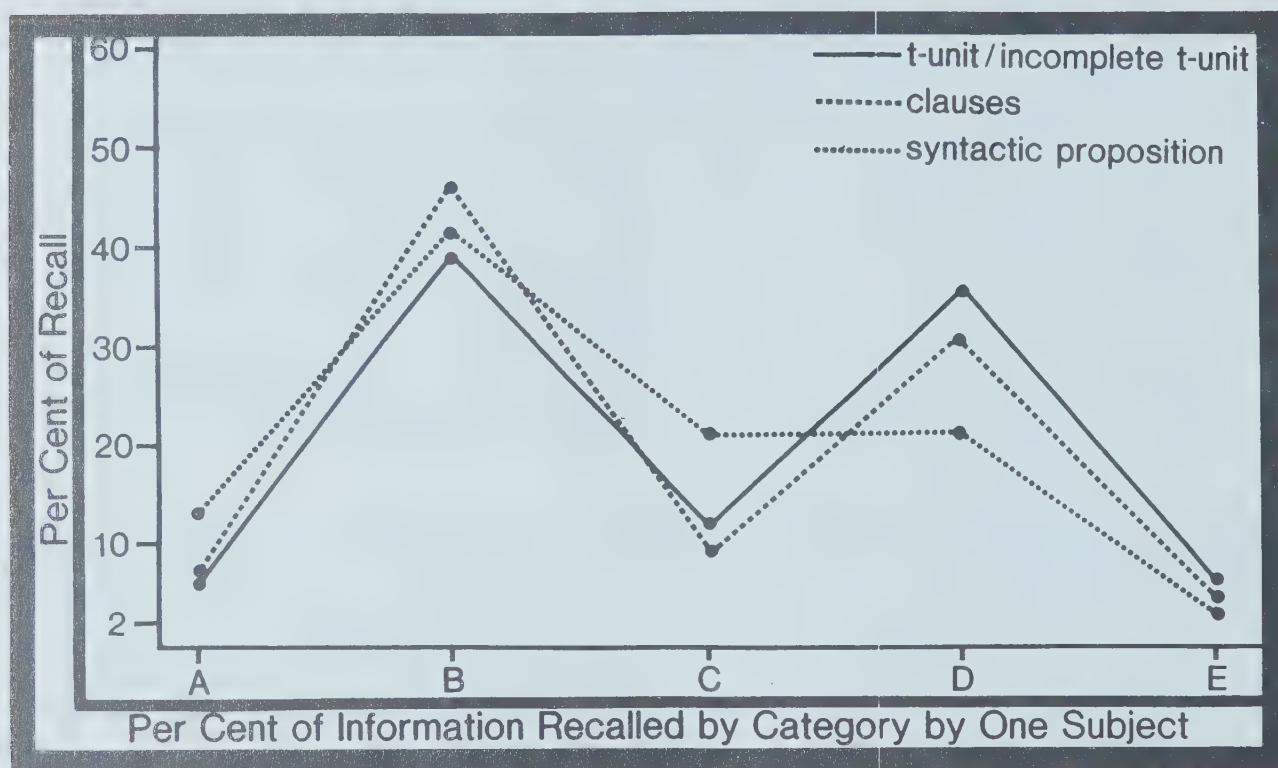


Figure 2.

The most striking difference among means for the three units was for Category C (Text Entailed). This was unexpected. Since this category involves the integration and synthesis of information from the text it was believed that the larger the unit chosen for analysis, the greater would be the mean of this category. However, the opposite situation occurred. To try and understand this result it is important to keep in mind that the unit of recall is the same as the text unit with which the recall is compared. Consider the examples below:

Text³: ¹/He said to her/I should like to sit up and watch tonight/that we may see/who it is/that comes and does my work for me. ²//They both liked the thought and made up their minds to try. ³//So they left a light burning and hid themselves in the corner of a room behind a curtain.//

Recall: //Then he said/he would stay up and see/who comes and who does my work.//

The single t-unit in the recall is roughly synonymous with the first text t-unit and thus would be categorized as Category B (Text Specific). The second clause in the recall is similar in meaning to "I should like to stay up and watch tonight" and would be classified as Category B. The second syntactic proposition in the recalls "he would stay up" is a synthesis (Category C) of the units "I should like" and "to sit up." The syntactic proposition "who comes" is a synthesis of "who it is" and

“that comes,” and the syntactic proposition “and who does my work” is a synthesis of “who it is” and “that does my work for me.” Thus by using the syntactic proposition, three units of the protocol would be assigned to Category C.

Another point that arises from these data is the small amount of information that was assigned to the Text Exact category. In a previous draft of these categories, this category was included with Text Specific and on the basis of the low means it might be suggested that they be recombined. However, one must keep in mind the purpose for which the analysis is going to be used. If it is going to be used for research and means alone are important, then separating the Text Exact category may not add a lot of information. However, should the analysis be used in a clinical diagnostic situation, then this category would help pinpoint those readers who try and regurgitate the text at a rote level. The spread of scores (percentages) of the 16 subjects for this category (0-12 for t-units/incomplete t-units, 0-9 for clauses, 0-13 for syntactic propositions) reflects the wide variation in this category.

The purpose of this study was to determine if differences occurred when recall data were assigned to categories on the basis of three units of analysis. This purpose was accomplished. However, a question that arises from these differences is which unit is the best to use. Since there were practically no differences between the t-unit/incomplete t-unit and the clause, the question is not between these but between these and the syntactic proposition. Since the study was not designed to answer this question and since the data do not provide an answer, the following points are based on speculation. The only significant correlations *within* the category system for each unit were between Text Exact and Text Specific ($p < .05$) for the t-unit/incomplete t-unit and clause, and between Text Exact and Text Entailed ($p < .01$)⁴ for the syntactic proposition. It must also be remembered that this latter category contained a higher percentage of information for the syntactic proposition than for the other two units. The latter correlation is also easier to explain since one would expect that the more concerned children are with the exact wording of the text, and less likely they are to integrate and synthesize information. However, when these same children's protocols were analysed according to different units this correlation disappeared. One explanation is that since these other two units were larger, the exact portion (as defined by the syntactic proposition) was now subsumed within a larger unit which was considered a paraphrase (Text Specific) of the text unit. Thus classifying by the larger units eliminated much of the information being assigned to the Text Exact category. The example below will illustrate this.

Text: //Once upon a time there was a shoemaker who worked very hard and
was honest/but still he could not earn enough money to live on.//

Recall: //Once upon a time a shoemaker worked very hard but did not have
enough to live on.//

The syntactic proposition “to live on” is Text Exact information (Category A). However, when the t-unit/incomplete t-unit or clause are considered, this now loses its Exact status and within the larger units becomes a paraphrase of the text (Category B).

One decision that might be considered in deciding which unit to use is the nature of the profile desired. If a researcher or diagnostician wishes to give credit for integrating smaller units of information from the text, then the decision is in

favor of the syntactic proposition. The fact that the analysis of data based on this unit resulted in a significant negative correlation between Text Exact and Text Entailed information, which was theoretically predicted, would also be a plus factor. In addition, the syntactic proposition is defined syntactically and semantically; consequently, it may be more sensitive to the meaning structure of the recall.

A point that must be considered, however, is the time factor in learning and applying these units. The t-unit/incomplete t-unit and clause are more simply defined and easier to employ than is the syntactic proposition. In addition, the interrater reliability although respectable (90.3 percent agreement) was lower for this unit than for the other two. The comprehension categories for protocol analysis have been established as a productive system within discourse analysis for describing the nature of the information which readers recall after reading a text. The question of which unit of analysis to use in assigning data to these categories has not been resolved. One way in which to provide further insights into this matter is to obtain data on a larger sample of subjects within which there is greater variation among reading scores. Research has shown that good readers (Beebe, 1981) and readers who make gains in a remedial reading program (Kavanagh, 1981) use more Text Specific and Text Entailed information. It is possible that the comprehension profiles of different types of reader will change depending on the unit of analysis used and that one kind of unit will give the best profile for all groups.

Notes

1. Initially adjectives were treated as separate units but continued work with children seemed to indicate that the adjective is most often included with the noun as a single idea, hence the "adjective (adjective) noun" was considered a single syntactic unit.
2. The protocols that were analysed in this study were taken from a study completed by Cronin in 1980; the sample, etc. is described in terms of her study.
3. // = t-unit, / = clause, — = syntactic proposition, → means a syntactic proposition is continued.
4. This was in a negative direction

References

- Bartlett, F.C. *Remembering*. London: Cambridge University Press, 1932.
- Beebe, M.J. *A model of the relationships between reading strategies and reading comprehension*. Unpublished doctoral dissertation. The University of Alberta, 1981.
- Brake, D. *An investigation of oral and silent reading with low and high achievers*. Unpublished master's thesis. The University of Alberta, Edmonton, 1981.
- Clarke, C.D. *A comparison of the unaided recalls of able and less able readers*. Unpublished master's thesis. The University of Alberta, Edmonton, 1981.
- Cronin, M.C. *The relationship of story grammar to recall of grade six Cree students*. Unpublished master's thesis. The University of Alberta, Edmonton, 1980.
- Drum, P.A. *Between sentence factors and the effects upon reading rate and recall*. Unpublished doctoral dissertation. Stanford University, 1974.
- Drum, P.A., & Lantaff, R.E. Scoring categories for protocols. Paper presented at the Second Annual Conference, Boston, October, 1977.
- Fagan, W.T. A comparison of the oral language of children ages nine, ten, and eleven. *A Research Report, Canada Council Grant S76-0563*. The University of Alberta, Edmonton, Alberta, 1978.

- Fagan, W.T. Comprehension categories for protocol analysis. In W.T. Fagan, C. Cooper, & J. Jensen (Eds.), *Measures for research and evaluation in the English language arts*, Volume 2. Urbana, Illinois: National Council of Teachers of English, in press.
- Frederiksen, C.H. Representing logical and semantic structure of knowledge acquired from discourse. *Cognitive Psychology*, 1975, 7, 317-458.
- Grimes, J.E. *The thread of discourse*. Ithaca: Cornell University, 1972.
- Hunt, K.W. Grammatical structures written at three grade levels. Urbana, Illinois: National Council of Teachers of English, 1965.
- Kavanagh, M.B. Processing differences on three reading levels between gain groups and no gain groups in a remedial reading situation. Unpublished masters research project. The University of Alberta, Edmonton, 1981.
- Kintsch, W. Notes on the structure of semantic memory. In E. Tulving & W. Donaldson (Eds.), *Organization of memory*. New York: Academic Press, 1972.
- Kintsch, W. *The representation of meaning in memory*. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1974.
- Kintsch, W. On comprehending stories. Paper presented at the Carnegie Symposium on Cognition, May 1976.
- Loban, W. Language development: Kindergarten through grade twelve. Urbana, Illinois: National Council of Teachers of English, 1976.
- Machura, S. Comprehension of perceptual connectives. Unpublished masters thesis. The University of Alberta, Edmonton, 1981.
- Mandler, J.M., & Johnson, N.S. Remembrance of things parsed: Story structure and recall. *Cognitive Psychology*, 1977, 9, 111-151.
- Meyer, B.J.F. & McConkie, G.W. What is recalled after hearing a passage? *Journal of Educational Psychology*, 1973, 65, 109-117.
- Meyer, B.J.F. *The organization of prose and its effects on memory*. Amsterdam: North Holland, 1975.
- Meyer, B.J.F. The structure of prose: Effects on learning and memory and implications for educational practice. In R.C. Anderson, R.J. Spiro, & W.E. Montague (Eds.), *Schooling and the acquisition of knowledge*. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1977.
- Rumelhart, D.E. Understanding and summarizing brief stories. (Technical Report No. 58). San Diego, California: Center for Human Information Processing, University of California, San Diego, 1976.
- Stein, N.L., & Glenn, C.F. An analysis of story comprehension in elementary school children. In R. Freedle (Ed.), *Discourse processing: Multidisciplinary perspectives*. Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1978.
- Strickland, R. The language of elementary school children: Its relationship to the language of reading textbooks and the quality of reading of selected children. Bulletin of the School of Education, Indiana University, 1962.
- Thorndyke, P.W. Cognitive structures in comprehension and memory of narrative discourse. *Cognitive Psychology*, 1977, 9, 77-110.
- Turner, A., & Green, E. *The construction and use of a propositional text base*. Technical Report No. 63. Institute for the Study of Intellectual Behavior, University of Colorado, Boulder, 1977.
- van Dijk, T.A., & Kintsch, W. Cognitive psychology and discourse: Recalling and summarizing stories. In W.U. Dressler (Ed.), *Trends in text linguistics*. New York: de Gruyter, 1976.
- Zinn, C. A comparison of high and low grade four readers on their use of the logical connectives "because." Unpublished master's thesis. The University of Alberta, 1979.

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Occupational Situs, Family Learning Environment and Children's Academic Achievement

This study examined the utility of adopting occupational situs categories in educational research by investigating relations between occupational status, family learning environments and children's academic achievement, for families from different occupational situses. Included in the sample were 900 Australian families divided into 10 occupational situses, where a situs was defined by the functional, rather than hierarchical, similarity of occupations. Discriminant analysis indicated separation among the situses in relation to two environment dimensions labelled family individualism and structured-achievement training. Regression surface analysis revealed that the environment dimensions and occupational status had differential associations with children's word-test performance, for families of different situses. The findings suggested that the type of learning environment created by families is related both to parents' occupational status and to the meanings that persons attach to their work activity.

One of the most consistent findings in educational research is that parents' occupational status is related to children's school achievement. Occupational indices in the form of single hierarchical status or prestige dimensions represent, however, a limited description of occupations. Our understanding of how parental occupations are associated with children's school outcomes may be enriched if other occupational measures were included in analyses. Cain and Treiman (1981, p. 253) have suggested, for example, that in sociological research "there has been increasing interest in expanding the repertory of occupational variables to include dimensions other than prestige and socioeconomic status." They claim that such interest derives from a

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recognition that other hierarchical dimensions such as power and authority are implicated in status attainment; a greater concern with structural features on inequality, often informed by Marxian or market-segmentation perspectives; and increasing interest in the intrinsic content of occupational roles. (p. 253)

It has also been proposed (Morris & Murphy, 1959; Murphy & Morris, 1961; Samuel & Lewin-Epstein, 1979) that investigations of occupational structure should examine separate categories, based on the functional similarity of occupations, to explore non-stratified aspects of occupations. Such qualitative, rather than hierarchical, categories have been labelled as occupational situs, where "a situs includes all those jobs, occupations, and professions which share a common function, mission, or focus of activity" (Samuel & Lewin-Epstein, 1979, p. 627). In discussing the potential utility of situs categories, Morris and Murphy (1959, p. 239) proposed that "the functional context of an occupation may make as much difference for the behavior or life style of the incumbent as the general prestige or socio-economic level of that occupation."

By adopting situs categories in educational research, occupations could be examined in relation to a vertical dimension defined by status and an horizontal dimension defined by situs. The introduction of such situs measures should be considered as a means of potentially increasing our understanding of the links between occupational structure and children's school behaviors rather than being regarded as a "competitor" to occupational status indices. It is realized, of course, that occupation forms only one element of family social context and that a more complete analysis of family social status would require an examination of measures such as parental education and family income. This study is limited to an examination of occupations. In the analysis, situs categories were included to examine: (a) relations between occupational situs and family learning environments, and (b) to what extent associations between occupational status, family learning environments, and children's academic achievement varied for families from different occupational situs.

Method

Sample

The data for the study were collected from 900 Australian families. Each family had an 11-year-old child attending an urban elementary school and the analyses related to those children. Findings from the investigation need to be interpreted within the limitation that the sample was not random. Attempts were made throughout the analyses, however, to make adjustments for the design effects of the sample. Jackknife estimates were based on four subsamples formed by randomly allocating families to the four groups. Pseudo-values for statistics were obtained from four sets of computations. In successive analyses different combinations of subsamples, taken three at a time, were used. Significance levels were then adjusted using the formula: standard error of sample estimate = (design effect)^{1/2} x simple random standard error (Kish, 1965; Ross, 1976). Also, the relatively small sample sizes within occupational situs categories prevented separate multivariate investigations of family learning environments for girls and boys, which was a further restriction of the study.

Measures

Occupational situs.

The assumptions underlying the situs conception are that occupations contribute to the fulfillment of a certain societal function, and that each function as such is equally necessary to the integrity of society. Hence, an overall situs classification of a given labor force in essence depicts the functional division of that society — above and beyond its diversification by income, authority, or prestige levels. (Samuel & Lewin-Epstein, 1979, p. 627)

Following this conception, Morris and Murphy (1969) and Samuel and Lewin-Epstein (1979) divided the occupational domain into 10 major situs categories, which were adopted for the present study. The situs categories were labelled: (1) legal authority — all those occupations concerned primarily with the formulation, arbitration, interpretation, and enforcement of the law (e.g., lawyer, the police); (2) finance and records — those occupations concerned with the handling of monetary affairs, accounts, or correspondence (e.g., clerk, secretary, teller, bookkeeper); (3) manufacturing — occupations involved with the fabrication of articles or processing of raw material on a production-line basis (e.g., production engineer, machine operator, quality-control expert, assembly-line worker); (4) transportation — all occupations concerned primarily with the movement of persons or goods from one location to another (e.g., navigator, bus driver, conductor, porter); (5) extraction — occupations involved in the extraction, procurement, or production of raw materials (e.g., farmer, geologist, miner, oil driller); (6) building and maintenance — all occupations concerned primarily with the construction of buildings or the installation, maintenance, and repair of equipment, property, and facilities (e.g., architect, bricklayer, repairperson, custodian, janitor); (7) commerce — those occupations related to the buying, selling, exchange, or marketing of goods or persons (e.g., exporter, car dealer, realtor, salesperson); (8) aesthetics and entertainment — all occupations associated primarily with the creation of art forms or with the provision of entertainment, recreation, information, or aesthetic satisfaction for the public (e.g., composer, impresario, reporter, performer); (9) education and research — those occupations related to formal instruction, training, or with the acquisition of knowledge (e.g., school teacher, experimentalist, college instructor); (10) health and welfare — all occupations concerned primarily with the detection, prevention or alleviation of illness, hazard, or distress (e.g., physician, therapist, social worker).

During interviews with parents, each respondent provided a detailed description of her or his occupation. Approximately half the mothers indicated that they were not involved in an occupation outside the family. Therefore, it was decided, where possible, to define occupational situs and status in relation to the occupations of fathers. In 65 families without fathers, mothers' occupations were used for the classification. An occupational scale developed at the Australian National University (Broom, Duncan-Jones, Lancaster Jones, & McDonnel, 1977) was used to categorize each occupation. The scale which is labelled the 'ANU-2 scale' includes descriptions of more than 400 occupations. The number of families classified into each situs category were: legal, 26; finance, 38; manufacturing, 204; transportation, 51; extraction, 136; building, 240; commerce, 115; aesthetics, 21; education, 44; and health and welfare, 25. Occupational status was also defined in relation to the categories of the ANU-2 scale.

Family learning environment. A social-psychological framework developed by Rosen (1956, 1959, 1961) for the study of achievement-oriented families was adopted as the basis for constructing a family learning environment schedule.

Rosen proposed that family learning environments could be characterized by variations in the interrelated components of achievement training, independence training, achievement-value orientations, and educational-occupational aspirations. Achievement training was defined as that socialization process in which "parents, by imposing standards of excellence upon tasks, by setting high goals for their child, and by indicating their high evaluation of his (her) competence to do a task well, communicate to him (her) that they expect evidences of high achievement" (1959, p. 50). For independence training, it is assumed that parents indicate to their children that they expect them to be self-reliant at the same time granting their children relative autonomy in decision-making situations. Therefore, while achievement training attempts to teach children to do things well, independence training tries to teach children to do things on their own. It was proposed by Rosen (1956) that these two family socialization practices act together to generate achievement motivation which provides children with the internal psychological impetus to excel in situations involving standards of excellence. Achievement-value orientations were defined as "meaningful and affectively charged modes of organizing behavior-principles that guide human conduct. They establish criteria which influence the individual's preferences and goals" (Rosen, 1959, p. 53). Rosen stated, however, that while achievement motivation and value orientations affect individuals' achievement by influencing their need to excel and their willingness to plan and work hard, they "do not determine the areas in which such excellence and effort takes place" (1959, p. 57). It was proposed that unless parents expressed high educational and occupational goals for their children, then the other socialization processes would not necessarily be associated with successful achievement. The family learning environment defined by the interaction of the four socialization processes was labelled by Rosen as the achievement syndrome.

A family environment schedule, in the form of a semi-structured parent-interview inventory, was constructed for the present study. The schedule assessed the following six dimensions: achievement orientation, press for English, press for reading, press for independence, individualistic-collectivistic value orientations, and parents' educational-occupational aspirations for their children. The concept, press, was adopted from Murray (1938, p. 16), who in his theory of personality suggested that if the behaviour of individuals was to be understood then it was necessary to devise a method of analysis that would "lead to satisfactory dynamical formulations of external environments." He proposed that an environment should be classified by the kinds of benefits or harms that it provided. If the environment had a potentially harmful effect, Murray suggested that individuals attempted to prevent its occurrence by avoiding the environment or defended themselves against it, while if the environment had a potentially beneficial effect then individuals would typically approach the environment and attempt to interact with it. The directional tendency of the environment implied in Murray's framework was designated as the press of the environment. Each press is defined as having a qualitative aspect which is the kind of affect that the environment has or might have upon an individual. Also each press has a quantitative aspect which is assessed by the variation in power that an environment has for either harming or benefiting individuals. In the present analysis, the first three environment dimensions identified were used to measure achievement training in families. In Rosen's analyses the language context of families was not included as part of the achievement syndrome. It was considered, however, that an assessment of the language environment of families would make

the achievement syndrome a more sensitive construct (see Marjoribanks, 1979, 1980).

Factor scaling techniques were used to develop scales to gauge the six dimensions of the family environment typology (Armor, 1974). Family environment scores for each child were obtained by adding the scores on those items making up each of the dimensions. Theta reliability estimates of the final scales were greater than 0.75. In the achievement-orientation scale were questions such as: How much time do parents expect their child to devote to homework or schoolwork at home; How often do parents praise their child for work done at school; and How often do parents discuss their child's progress at school. The press for English dimension consisted of items of the form: How often would you help your child with English grammar (e.g., tell the child how to construct sentences, when to use certain words); How particular would you say you are about the way your child speaks English (correct grammar, good vocabulary). Press for reading did not relate to any particular language and the scale included items such as: How many books do parents read in a month, When the child was small how often did the parents read to her/him, and How many books does the child bring home from libraries each month. Press for independence was measured using items in which parents indicated the age they would allow their child to undertake certain activities. The individualistic-collectivistic achievement-value orientation scale consisted of items similar to those used by Strodtbeck (1961) to measure independence of family and they were of the form: Even when a girl (boy) gets married her (his) main loyalty still belongs to her (his) parents; When the time comes for a daughter (son) to take a job, she (he) should try and stay near her (his) parents, even if it means giving up a good opportunity, and Nothing in life is worth the sacrifice of moving away from one's parents. The parents' aspirations scale included items of the form: How much education do you want your child to receive; How much education do you really expect your child to receive; and What kind of job would parents really like their child to have. Interviewing in homes was conducted by government social survey interviewers (see Marjoribanks, 1982a, 1982b).

Academic achievement. Standardized tests devised by the Australian Council for Educational Research were used to assess children's achievement in word knowledge and word comprehension (Primary Reading Survey Tests) and in mathematics (Class Achievement Tests in Mathematics). In an attempt to create as uniform test-taking contexts as possible, I administered the test program in the children's classrooms.

Results

(a) *Occupational situs and family learning environments.*

Environmental differences among the 10 situs categories were examined using discriminant analysis, which as Nunnally (1967, p. 373) has suggested is a method of profile analysis that allows hypotheses to be tested "about the extent to which a priori groups 'hang together'." Two discriminant functions were identified as having significant discriminatory power among the occupational situses. The first function was interpreted as an individualism dimension as it was defined substantially by individualistic-collectivistic value orientations and, to a lesser extent, by press for independence. Press for English, press for reading, and

achievement orientations defined the second function which was labelled as a structured-achievement training dimension.

In Figure 1, the group centroids in relation to the two discriminant dimensions are presented, where “a centroid is simply the point representing the average profile of a group” (Nunnally, 1967, p. 390). The first function reflected a strong separation between the environment profiles of the manufacturing-situs category and the occupational groups of transport, health and welfare, education, and finance. There was a modest separation among the situs for the second discriminant function, with the legal and manufacturing groups exhibiting the most significant separation.

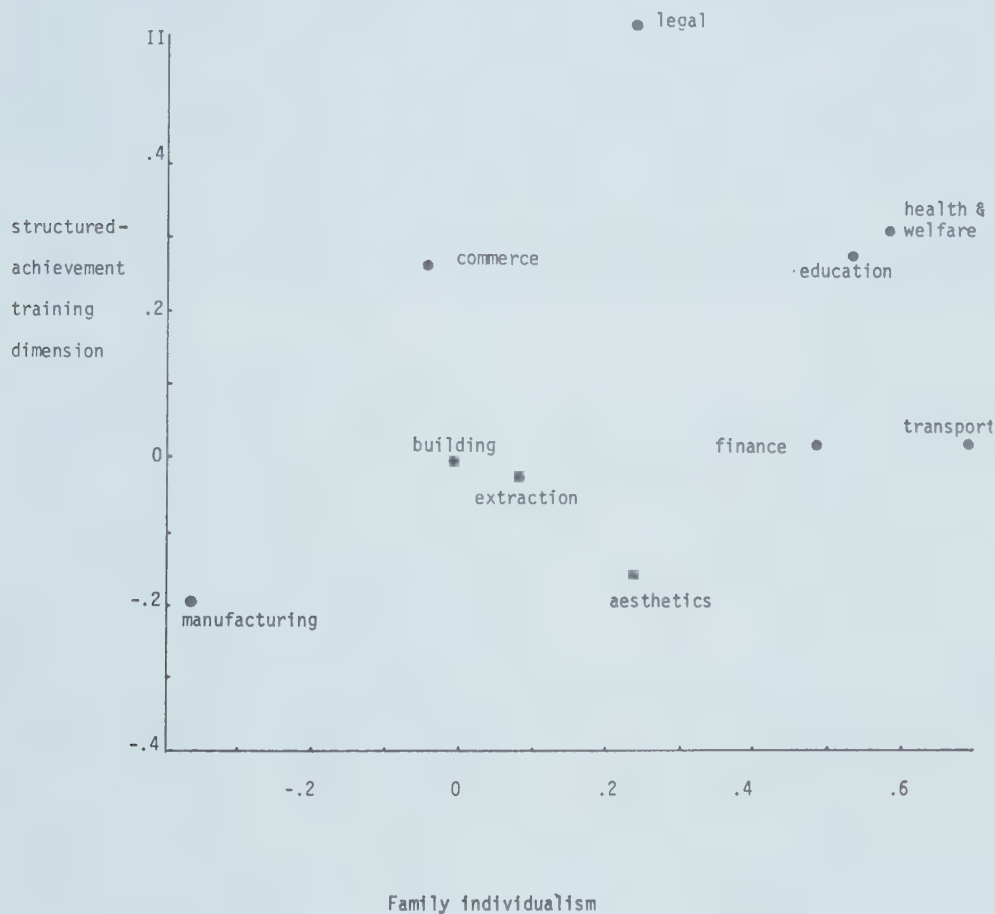


Figure 1. Situs centroids in relation to family environment discriminant dimensions.

A social status measure, which was a combination of occupational status and the education level of parents, was adopted to examine whether there were mean differences in the social status of situs categories. The results indicated, for example, that while there were no significant differences in the mean social-status scores of the transport, commerce, extraction, building, and manufacturing categories there were significant differences between the environment centroids for those situs. In Figure 2, the profiles of mean environment scores for those five situs are presented to indicate further the nature of the situs-group differences in family environments. Scores were standardized with means of 50 and standard deviations of 10, calculated over the total sample. Parents in the transport category, for example, were characterized by modest aspirations, relatively strong press for English and reading, positive achievement orientations, moderate press

for independence, and highly individualistic-achievement value orientations. Parents from the commerce situs had a similar environment pattern but with less individualistic orientations and lower press for reading. In contrast, the manufacturing-situs families expressed modest aspirations, low press for English and reading, negative achievement orientations, weak press for independence, and strong collectivistic value orientations. The environment scores in the building and extraction situses reflected the presence of relatively modest achievement-oriented family learning environments.

In multiple regression models, where the situs data formed a set of mutually exclusive categories and the environment dimensions were the criterion measures, occupational situs was typically associated with modest percentages of the variance in the environment scores, when calculated over the total sample. Multiple correlations between occupational situs and environment dimensions were: press for English, 0.31; press for reading, 0.22; achievement orientations, 0.23; press for independence, 0.20; and achievement-value orientations, 0.23. Parents' aspirations were not related to occupational situs. Overall, the initial findings of the analysis provided support for the proposition that parents from different occupational situs categories created different learning environments for their children.

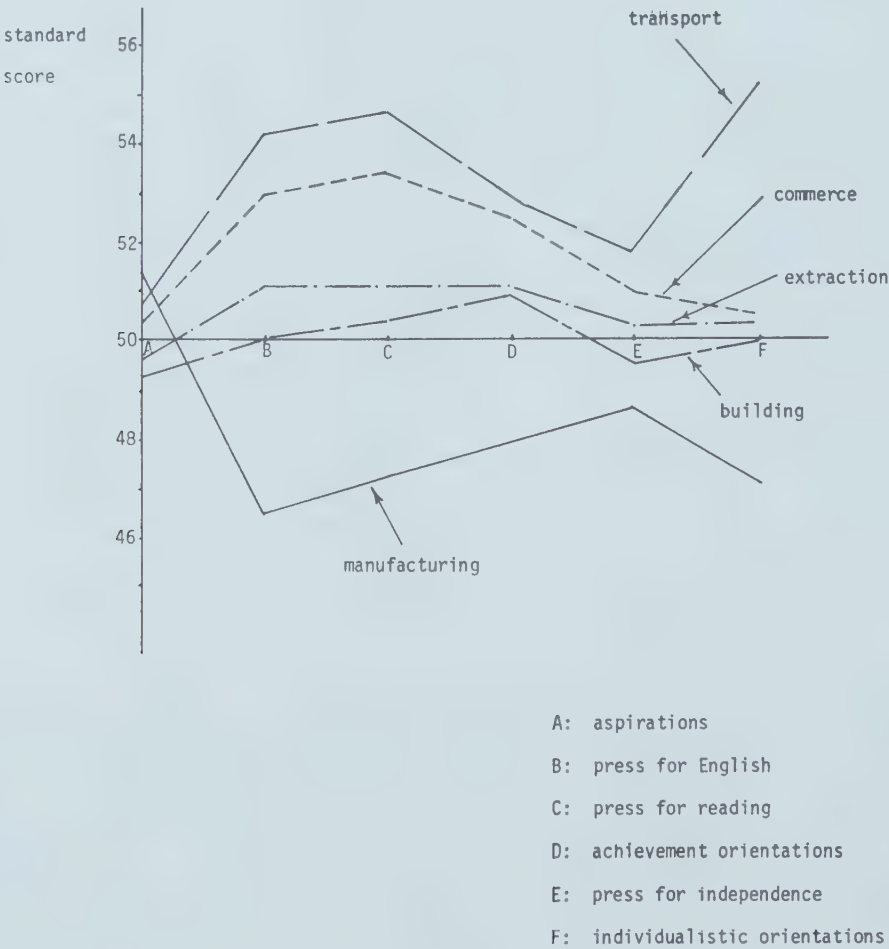


Figure 2. Situs-patterns of family environment dimensions.

(b) *Situs, status, family environment and children's achievement*

The utility of adopting occupational situs categories in educational research was investigated further by examining relations between occupational status, family learning environments and children's academic achievement for families from different occupational situses. Regression surfaces were plotted to examine the associations. Previous research has suggested that environment measures may be related differentially to children's achievement at various levels of social status and that changes in environments may be associated with variations in children's achievement only until environment threshold levels are attained. Therefore, interaction and curvilinear (squared) terms were included in the regression models used to generate the response surfaces. Two-stage hierarchical regression analyses were adopted to generate raw regression weights that were used to plot the planes. In stage one, predictors were introduced successively in the order: occupational status, family environment, occupational status-environment interaction, (status)², and (environment)². That is, the regression equations were of the form:

$$Y = aX + bZ + cXxZ + dX^2 + eZ^2 + \text{constant},$$

where Y, X, and Z represented measures of academic achievement, occupational status, and family environment, respectively. As Cohen (1978, p. 863) has suggested,

when we linearly partial from the product its constituents, we have an interaction, for example $X \times Z = XZ \cdot X, Z$. Similarly, when we linearly partial from an integral power its constituent(s), we have a curve component, for example $X \times X = XX \cdot X$. Further, just as $XZ \cdot X, Z$ is necessarily orthogonal to X and Z, whatever the correlations among X, Z, and XZ, so, too, is $X^2 \cdot X$ necessarily orthogonal to X, whatever the correlation between X and X^2 (usually close to unity). Partialled variables (residuals) correlate precisely zero with the variables that have been partialled from them, by construction (or definition).

That is, an XxX interaction ($X^2 \cdot X$) can be interpreted as meaning that the slope of the Y on X regression lines varies as X varies. Polynomials may be analyzed in hierarchical regression equations with "linear functions preceding quadratic preceding cubic, and so on, and with main effects preceding two-way preceding three-way interactions, and so forth, so that terms of lower order are partialled from those of higher order and not vice versa" (Cohen, 1978, p. 866). In the second-stage of the hierarchical regression analyses, interaction and squared terms not related to achievement were deleted from the models and associations between achievement and the remaining predictors were recalculated.

For the analysis, word knowledge and word comprehension were combined into a composite word-test score. Also, from the findings of the discriminant analysis two family environment measures were generated. These were labelled family individualism, a combination of achievement value orientations and press for independence; and structured-achievement training, a composite of press for English, press for reading, and achievement orientations. The regression surface analysis was conducted in the four occupational situses of building, commerce, extraction, and manufacturing. These occupational categories had similar distributions of occupational status and had sufficient families to permit multivariate analysis.

TABLE 1

RELATIONS BETWEEN OCCUPATIONAL STATUS,
FAMILY ENVIRONMENT AND ACADEMIC ACHIEVEMENT
WITHIN DIFFERENT OCCUPATIONAL SITUS CATEGORIES

Predictor Variables	Occupational Situs							
	Manufacturing		Extraction		Building		Commerce	
	Word	Math	Word	Math	Word	Math	Word	Math
Occupational	1.364 ^a	.717	.994	.698	7.616	.444	8.121	1.223
Status	.098	.052	.038 ^b	.018 ^b	.076	.025	.079	.092
Achievement	.127	.049	.043	-.045	.375	.031	.782	.010
Training	.016	.005 ^b	.002 ^b	.005 ^b	.019	.002 ^b	.001 ^b	.001 ^b
Status X	c	c	c	c	.109	c	-.060	c
Training					.025		.033	
(Status) ²	c	c	c	c	-.316	c	c	c
					.032			
Multiple R	.339***	.238**	.200	.151	.388***	.163*	.334**	.303**
Occupational	-8.441	.858	.719	.580	4.619	.211	1.910	1.223
Status	.098	.052	.038 ^b	.018 ^b	.076	.025	.079	.092
Individualism	-1.309	.009	.357	-.032	.230	.300	.024	.042
	.001 ^b	.001 ^b	.035	.001 ^b	.077	.051	.001 ^b	.001 ^b
Status X	.150	c	c	c	c	c	c	c
Individualism	.079							
(Status) ²	c	c	c	c	-.212	c	c	c
					.030			
Multiple R	.422***	.228**	.270**	.135	.430***	.274***	.280**	.304**

Notes. ^a Raw regression weights are uppermost in each pair of numbers while lowermost is the amount of variance associated with the addition of each predictor to the regression.

^b The variance associated with the addition of the predictor is not significant.

^c Variables not included in the second stage of the hierarchical regression analyses.

* $p < .05$
** $p < .01$
*** $p < .001$

Regression surfaces were constructed using the raw regression weights in Table 1. Typically, within each situs category, occupational status and the family environment measures combined to have modest relations to the word-test scores. Mathematics achievement, however, tended not to be associated with the environment measures at different levels of occupational status. Only in the building category was (occupational status)² associated with an increase in the variance of word-test scores while (environment)² was not related uniquely to the achievement measures in any of the situs categories. As it was not possible to present all the regression surfaces generated for the study, six surfaces have been plotted in two figures. The surfaces represent the major situs-group differences in relations among the measures. In the figures, scores were standardized with means of 50 and standard deviations of 10. The surfaces in Figure 3 show the regression-fitted relations between family individualism and word-test scores at different levels of occupational status, for families from the manufacturing, extraction, and building situses. The shape of the surface for the manufacturing situs reflects the presence of a significant interaction between occupational status and family individualism. At low status levels, increases in family individualism were associated with decrements in word-test scores while at high status levels, increasing individualism was related to increments in word performance. That is, in the low status manufacturing-situs families there appeared to be a conflict between increasing individualism and children's word achievement. In contrast, for high status manufacturing-situs families, increased individualism was related strongly to increased word-test performance. For extraction-situs families, increases in individualism scores were associated with increments in word-test achievement at each level of occupational status, while at each environment value there was no relation between status and achievement. In the building situs, word performance had significant linear associations with occupational status and family individualism, and also significant curvilinear relations to occupational status. At each status level, for example, regression-fitted word-test scores increased by approximately 10 points over the range of individualism values.

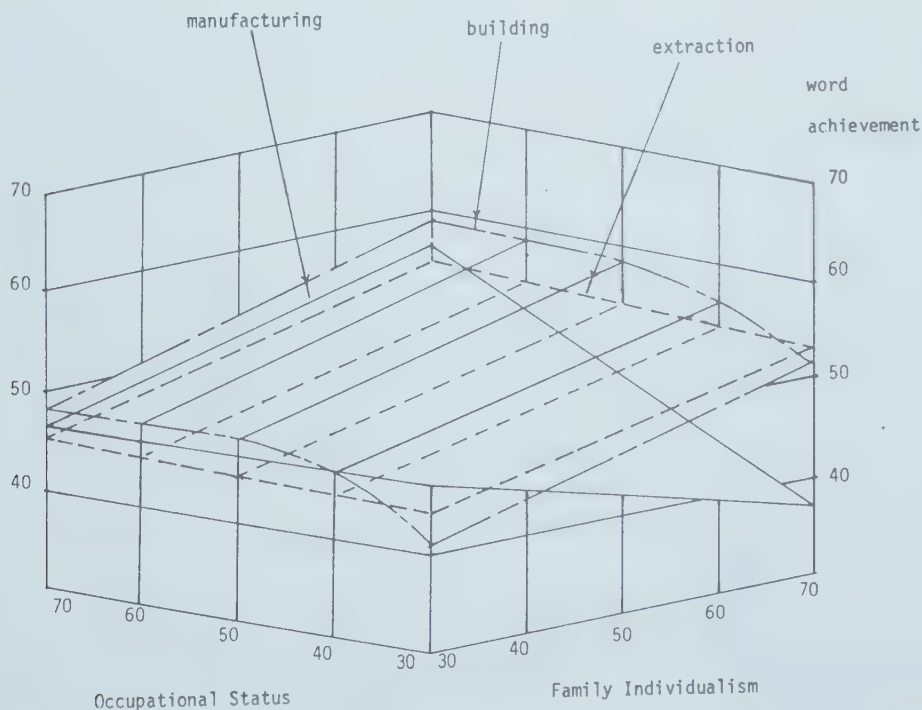


Figure 3. Fitted-word scores in relation to occupational status and family individualism.

Increases in occupational status at each environment level, however, were related to increments in achievement scores only until a threshold level of status was attained. After that threshold level, approximately 50, further increases in occupational status were not associated with changes in word achievement. Thus the regression surfaces in Figure 3 indicated that family individualism and occupational status were related differentially to word-test achievement, for families from different occupational situses.

In Figure 4, the surfaces show the regression-fitted relations between structured-achievement training, occupational status, and word-test achievement for families from the building, manufacturing, and commerce situses. Again, the surfaces revealed that the environment and status measures had different associations with achievement within the various situses. For manufacturing-situs families, increases in occupational status were related to similar increments in the word scores at each environment level. In contrast, for building-situs families, occupational status had a negatively increasing association with achievement while for commerce-situs families, status and achievement were related at low environment values but not at high-achievement training scores. Also, the shapes of the surfaces indicated that at each level of occupational status, increases in structured-achievement training were associated with increments in the regression-fitted word-test scores for the building and manufacturing situses, but the associations in the commerce situs were significant only at low status levels.

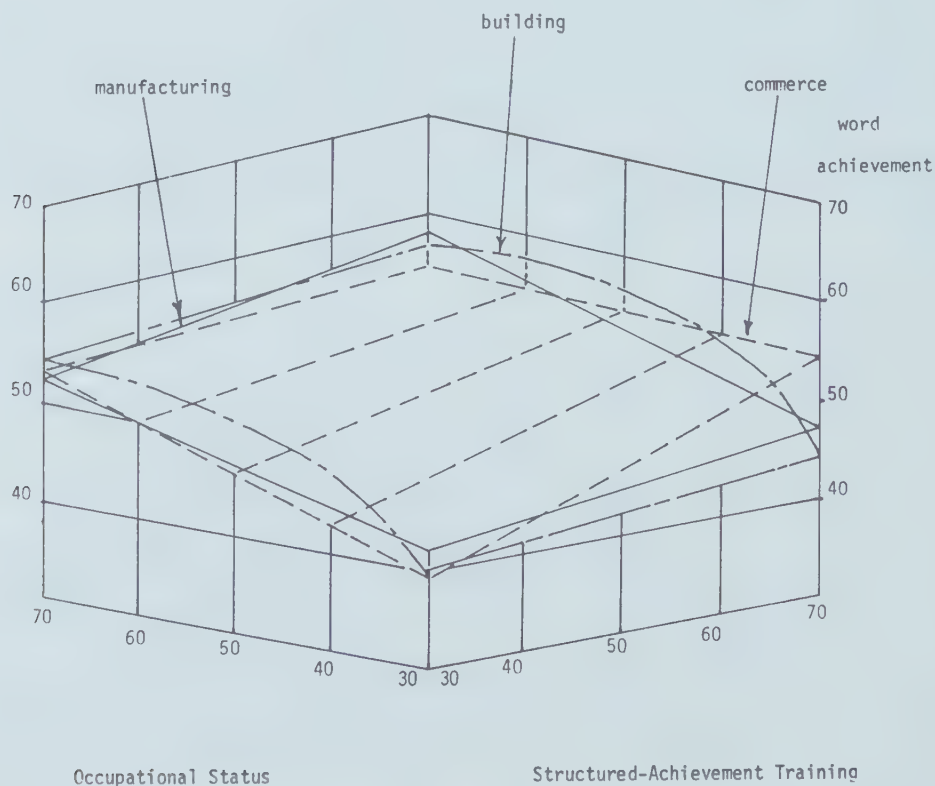


Figure 4. Fitted-word scores in relation to occupational status and structured-achievement training.

Discussion

Typically, research has shown that measures of family learning environments and occupational status are related to children's academic achievement. It has been suggested, however, that it may not be valid to generalize such findings for families from different ethnic groups (e.g., see Walberg & Marjoribanks, 1976; Clarke-Stewart & Apfel, 1978; Marjoribanks, 1980). The present analysis also suggests caution in generalizing such findings for families of different occupational situses.

The concept of occupational situs assumes that the meanings and functions that persons attach to their work activity influence their attitudes and behaviours, both inside and outside work situations. This study suggests that the type of learning environment created in families is related both to parents' occupational status and to the meanings that persons attach to their work activity. Therefore, educational research that investigates the social circumstances surrounding children's school-related behaviours might be enriched by examining the status and situs characteristics of occupations. Bloom (1980, p. 15) has proposed that "there is a curriculum and teaching style in each home and that it is the variations in the home curriculum and teaching which account for much of the differences in children's preparation for the learning tasks in the school." Research is now required which examines the meanings that workers give to their work activity and how such meanings are related to the curriculum and teaching styles adopted in families. When such research is completed it is likely that our theoretical understanding of relations between occupational structure and children's school behaviour will be greatly enhanced.

References

- Armor, D.J. Theta reliability and factor scaling. In H.L. Costner (Ed.), *Sociological methodology, 1973-1974*. San Francisco: Jossey-Bass, 1974.
- Bloom, B.S. The new direction in educational research: Alterable variables. In K.D. Sloane & M.L. O'Brien (Eds.), *The state of research on selected alterable variables in education*. Chicago: University of Chicago, 1980.
- Broom, K., Duncan-Jones, P., Lancaster Jones, F., & McDonnel, P. *Investigating social mobility*. Canberra: Australian National University Press, 1977.
- Cain, P.S., & Treiman, D.J. The Dictionary of Occupational Titles as a source of occupational data. *American Sociological Review*, 1981, 46, 253-278.
- Clarke-Stewart, K.A., & Apfel, N. Evaluating parental effects on child development. In L.S. Shulman (Ed.), *Review of research in education*. Itasca, Illinois: Peacock, 1978.
- Cohen, J. Partialled products are interactions; partialled powers are curve components. *Psychological Bulletin*, 1978, 85, 858-866.
- Kish, L. *Survey sampling*. New York: Wiley, 1965.
- Marjoribanks, K. *Families and their learning environments*. London: Routledge and Kegan Paul, 1979.
- Marjoribanks, K. *Ethnic families and children's achievements*. London: Allen and Unwin, 1980.
- Marjoribanks, K. Sibling and family environment correlates of children's achievement: Ethnic group differences. *Journal of Biosocial Sciences*, 1982, 14, 99-107. (a)
- Marjoribanks, K. Fifteen thousand hours: A related study of family-school differences. *Educational Studies (England)*, 1982, 8, 45-53. (b)

- Morris, R., & Murphy, R. The situs dimension in occupational literature. *American Sociological Review*, 1959, 24, 231-239.
- Murphy, R.J., & Morris, R.T. Occupational situs, subjective class identification, and political affiliation. *American Sociological Review*, 1961, 26, 383-392.
- Murray, H. *Explorations in personality*. Oxford: University Press, 1938.
- Nunnally, J.C. *Psychometric theory*. New York: McGraw Hill, 1967.
- Rosen, B.C. The achievement syndrome: A psychocultural dimension of stratification. *American Sociological Review*, 1956, 21, 203-211.
- Rosen, B.C. Race, ethnicity, and achievement syndrome. *American Sociological Review*, 1959, 24, 47-60.
- Rosen, B.C. Family structure and achievement motivation. *American Sociological Review*, 1961, 26, 574-584.
- Ross, K.N. *Searching for uncertainty*. Melbourne: Australian Council for Educational Research, 1976.
- Samuel, Y., & Lewin-Epstein, N. The occupational situs as a predictor of work values. *American Journal of Sociology*, 1979, 85, 625-639.
- Strodtbeck, F.L. Family interaction, values and achievement. In A.H. Halsey, *et al.* (Eds.), *Education, economy, and society*. New York: Free Press, 1961.
- Walberg, H.J. & Marjoribanks, K. Family environment and cognitive development: Twelve analytic models. *Review of Educational Research*, 1976, 46, 527-551.

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Principal Authenticity, School Climate, and Pupil-Control Orientation

Hypotheses concerning the relationships among leader authenticity of the principal, openness of organizational climate, and humanism in pupil-control orientation were developed and tested. The Leader Authenticity Scale (LAS), subtests of the Organizational Climate Description Questionnaire (OCDQ), and the Pupil Control Ideology Form (PCI) were used to measure the variables in 42 elementary schools. All hypotheses were confirmed. Leader authenticity of principals was significantly related to openness in organizational climate and to humanism in pupil-control orientation of the school; and openness in climate was significantly related to humanism in pupil-control orientation. The results supported the assumption of the pivotal importance of leader authenticity in the development of the organizational climate of elementary schools.

In some schools behavior of teachers and principals is vibrant and complex; it seems real and genuine. In other schools, behavior is forced, shallow, and stereotyped; for the most part it is a hollow ritual in which individuals seem like actors on stage who have learned their parts by rote, but who perform without commitment (Halpin, 1966). Indeed, Halpin and Croft (1963) concluded their pioneering research of the organizational climate of schools with the observation that the chief consequence of their research was the identification of the pivotal importance of authenticity in organizational behavior. Little research has been

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performed that directly addresses the authenticity of behavior of principals and teachers in schools; thus, the major purpose of this investigation was to develop and test a number of hypotheses relating the perceived authenticity of principals to the organizational climate and control orientations of schools.

Principal Authenticity

Leader authenticity is a fuzzy concept. People glibly talk about genuine, real, and authentic behavior, yet it is another matter to provide a clear and concise constitutive definition, let alone an operational one. Nonetheless, a comprehensive review of the literature revealed three major aspects of leader authenticity — accountability, manipulation, and salience of self over role (Henderson & Hoy; 1982). Leader authenticity thus was defined as the extent to which subordinates described their leader as accepting responsibility for actions, as being non-manipulating, and as demonstrating a salience of self over role. In contrast, the inauthentic leader was viewed as one who “passes the buck,” blames others and circumstances for his/her errors, manipulates and uses subordinates, and is engulfed in the bureaucratic role requirements of the position.

A major problem that complicates any attempt to define the concept is the difference between (1) the authenticity of behavior as perceived by the participants in a given situation and (2) the authenticity of behavior as perceived by an external observer who attempts to evaluate this authenticity against an absolute standard (Halpin, p. 207). In this study authenticity of the leader's behavior was defined by teachers' perceptions of the principal's behavior in relative rather than absolute terms.

Organizational Climate

Organizational climate is an enduring quality of the internal environment of an organization as experienced by its members. The most well-known conceptualization of school climate is Halpin and Croft's (1963) description of the atmosphere of schools along a continuum of teacher-principal behaviors from open to closed. These contrasting types of climate are “ideal types,” that is, pure analytic abstractions.

The open climate is an energetic, lively organization that is moving towards its goals while simultaneously providing satisfaction for the group members' social needs. Morale is high. Leadership acts emerge freely from either the teachers or the principal. The principal leads through example by providing the proper blend of structure and direction as well as support and consideration. Teachers do not overemphasize either task achievement or social needs satisfaction, but in both instances satisfaction seems to be obtained easily and almost effortlessly. The most striking feature of the open climate is the genuine behavior of both teachers and the principal.

At the other extreme, the closed climate is beset with a pervasive apathy among organizational members. The school seems stagnant because satisfaction is obtained from neither task achievement nor fulfillment of social needs. Teachers are disengaged; they simply go through the motions. Morale is low, and the principal is ineffective in attempts to move the organization by close supervision. Members play games with each other; their behavior is not genuine.

Pupil-Control Orientation

Another way to conceptualize the internal environment of the school is in terms of the control patterns employed by teachers and principals to direct students. The significance of pupil control in both the structural and normative aspects of the school culture has been well documented (Waller, 1932; Willower, Eidell & Hoy, 1967; and Hoy & Miskel, 1978); in fact, the dominant pupil-control orientations in schools have been used to distinguish between schools along a custodial-humanistic continuum. These contrasting terms refer to types of individual ideology and to the corresponding types of school organization that they seek to rationalize and justify.

The model for the custodial orientation is the traditional school, which provides a rigid and highly controlled setting concerned primarily with the maintenance of order. Students are stereotyped in terms of their appearance, behavior, and parents' social status. Teachers who hold a custodial orientation conceive of the school as an autocratic organization with a rigid pupil-teacher status hierarchy. The flow of power and communication is unilateral and downward; students must accept the decision of their teachers without question. Teachers do not attempt to understand student behavior, but instead view misbehavior as a personal affront. Students are perceived as irresponsible and undisciplined persons who must be controlled through punitive sanctions. Impersonality, cynicism, and watchful mistrust pervade the atmosphere of the custodial school.

The model for the humanistic orientation is the school conceived as an educational community in which students learn through cooperative interaction and experience. Learning and behavior are viewed in psychological and sociological terms, not moralistic ones. Self-discipline is substituted for strict teacher control. Humanistic orientations lead teachers to desire a democratic atmosphere with open channels of two-way communication between pupils and teachers and increased self-determination. In brief, a humanistic orientation is used in the sociopsychological sense suggested by Fromm (1948). It indicates an orientation that stresses the importance of the individuality of each student and the creation of an atmosphere to meet the wide range of student needs.

Rationale and Hypotheses

The major hypotheses guiding this study rest on the following two basic assumptions:

1. The principal is the single most important individual in setting the tone of relationships in an elementary school.
2. The perceived authenticity of the elementary principal's behavior has a pervasive influence on organizational climate.

Halpin (1966) uses the term, authenticity, to represent behavior which is "for real," that is, genuine or without pretense. He argues the distinguishing feature of elementary schools with an open climate is group authenticity. Behavior is not submerged by bureaucratic role demands. To the contrary, the open school climate provides enough flexibility in the specification of roles to permit individuals to be more themselves, that is, to adjust the role to their personal need-dispositions. Within the closed climate, however, the role itself and the individual's status as a teacher or a principal constitutes one's essential sense of identity. Furthermore,

the individual uses the role ritualistically, so that it becomes a device to keep others at a distance and to preclude the establishment of authentic relationships (Halpin, p. 205).

If the principal is perceived as one who accepts responsibility for his or her actions, does not manipulate subordinates, and demonstrates an importance of self over role, then teachers seem less likely to use their own professional role as a mask to hide their personal identity. In this instance, relationships among teachers and between teachers and the principal should be relatively open, genuine, and authentic. However, if the principal is viewed as one who "passes the buck," blames others for one's mistakes, manipulates subordinates, and hides behind the authority role, then relationships in the school organization will likely be guarded, phoney, and protective. Hence, it was hypothesized that:

H₁ The greater the degree of perceived authenticity of the elementary school principal, the more open the organizational climate of the school.

Similarly, the perceived authenticity of the principal's behavior should be related to the pupil-control orientation of schools. Public schools are service organizations specifically vested with the cognitive and affective socialization of the young. However, they are a special type of service organization in which clients are unselected and participation is mandatory. Such organizations are frequently confronted with clients who have little motivation to take advantage of the services, and control of clients is a major organizational problem (Carlson, 1964). Public schools are no exception. The control of student-clients consistently has been found to be a significant feature of organizational life of schools; in fact, pupil control has been described as the "dominant motif" within the school social system and the integrative theme that gives meaning to patterns of teacher-teacher and teacher-principal relations (Waller, 1932; Willower & Jones, 1963; Willower, Eidell & Hoy, 1967; and Hoy, 1972).

If the principal promotes authentic behavior through example, it seems likely that such behavior will create a humanistic atmosphere in the school that stresses the importance of the individuality of each person — teachers and students alike. Rigid role definitions will fade. Students seem less likely to be stereotyped in terms of behavior and parents' social status. Self-discipline rather than punitive control, cooperation rather than isolation, and democratic rather than autocratic interactions seem likely consequences of authentic principal behavior. Hence, it was hypothesized that:

H₂ The greater the degree of perceived authenticity of the elementary school principal, the more humanistic the pupil control orientation of the school.

If interactions among teachers and between teachers and the principal are authentic in the open school climate, then it seems reasonable that the authenticity would pervade teacher-pupil interactions (Appleberry & Hoy, 1969). The humanistic pupil control orientation should facilitate and be facilitated by authentic teacher-pupil interactions.

The inauthenticity of the closed climate seems likely to increase teachers' fear of criticism, especially criticism concerning poor discipline or lack of control; hence, teachers will attempt to keep others at a distance and strive to maintain custodial control over students. The open climate, however, should provide a situation where teachers are more relaxed and less fearful of criticism from their colleagues, a climate that should foster more authentic pupil-teacher relationships and a more humanistic pupil-control orientation. Thus, it was hypothesized that:

H₃ The more open the organizational climate of an elementary school, the more humanistic the pupil-control orientation of the school.

Method

Operational Measures

Leader authenticity was measured by use of the Leader Authenticity Scale (LAS), a 32-item Likert scale on which respondents indicate the extent of their agreement. The LAS was developed in a comprehensive factor analytic study of the behavior of elementary principals. Items measuring accountability, non-manipulation of subordinates, and salience of self over role, as anticipated, loaded highly on a single bipolar authenticity factor, and construct validity for the scale was demonstrated (Henderson & Hoy, 1982). Examples of items included the following: "The principal is willing to admit mistakes when they are made"; "The principal manipulates the teachers"; and "The principal is a person first and an administrator second." Reliability for the LAS in the present sample was strongly supported with an alpha coefficient of .96.

Openness in the organization climate of a school was established with the Organizational Climate Description (OCDQ). The OCDQ is a 64-item Likert instrument composed of eight subtests. Respondents are asked to indicate the extent to which each statement characterizes their school from rarely occurs to very frequently occurs. Three of the subtests (Thrust, Esprit, and Disengagement) combine to form an index of the openness of the school climate (Halpin, 1966; Hoy, 1972a). Samples of items included the following: "The mannerisms of teachers at this school are annoying"; "Most of the teachers here accept the faults of their colleagues"; and "The principal sets an example by working hard himself." Reliabilities for the subtests in the present study ranged from .76 to .89. Construct validity of the openness index has been supported in a number of studies (Andrews, 1965; Hoy, 1972; Hartley & Hoy, 1972).

The pupil-control orientation of the school was measured by a 20-item instrument, the Pupil Control Ideology (PCI) form. Responses to each item are made on a Likert-type scale and are scored from strongly agree to strongly disagree; the higher the score the more custodial (less humanistic) the response. Examples of items included the following: "A few pupils are just young hoodlums and should be treated accordingly"; "It is often necessary to remind pupils that their status in schools differs from that of teachers"; and "Pupils can be trusted to work together without supervision" (score reversed). Validity of the scale has been consistently supported (Willower, Eidell & Hoy, 1967; Hoy, 1972). Reliability of the scale for the present sample was established with an alpha of .79.

Sample

Data were collected from 591 teachers in 42 elementary schools in New Jersey, 90% of the teachers in all schools. One half of the teachers were selected at random in each school and responded to the LAS; the other half responded to the OCDQ climate index and the PCI measure. The unit of analysis was the school, however, not the teachers; hence, data for each school were pooled and averaged to determine the degree of openness of school climate, the extent to which a school had a humanistic pupil-control orientation, and the authenticity of the behavior of the principal.

Results

The hypotheses were tested using correlational analysis and all three hypotheses were supported. The perceived authenticity of the principal was strongly related to the openness of the school climate; the more authentic the principal, the more open the organizational climate ($r = .63, p < .01$). Similarly, as predicted, the greater the degree of authenticity as described by teachers, the more humanistic (less custodial) the pupil control orientation of the school ($r = -.49, p < .01$). Finally, as hypothesized, the more open the organizational climate, the more humanistic the pupil-control orientation of the school ($r = -.44, p < .01$) (see Table 1).

TABLE 1
SUMMARY OF CORRELATIONAL DATA
USED TO TEST THE HYPOTHESES

Hypothesis	N for Schools	r	p
1. Authenticity of Principal with Openness of School Climate	42	.63	.01
2. Authenticity of Principal with Pupil-control Orientation of School	42	-.49	.01
3. Openness of School Climate with Pupil- control Orientation of School	42	-.44	.01

Summary and Conclusions

The rationale for the hypotheses of this study stressed the significance of the principal's role in setting the tone of relationships in elementary schools. It was assumed that authentic principal behavior would pervade teacher-teacher as well as teacher-principal relationships producing a more open climate where individual behavior was not submerged by bureaucratic role demands; and teachers could be more themselves and adjust the role to their personality needs. We also theorized that if the principal promoted authentic behavior through example, that is, accepted responsibility for one's own actions, did not hide behind formal authority, and avoided manipulating others, then such behavior would foster a humanistic pupil-control atmosphere in the school, one that stressed the importance of the individuality of teachers and students alike. Self-discipline rather than punitive control, cooperation rather than isolation, and democratic rather than autocratic relations would be fostered by authentic principal behavior. The confirmation of the hypotheses that perceived leader authenticity of the principal was significantly related to the openness of the organizational climate and to the pupil-control orientation of the school supports this theoretical rationale.

Consistent with earlier research (Appleberry & Hoy, 1969), this research stressed the authenticity of interactions among professional personnel in schools with an open climate. It was postulated that if professional interactions were authentic, then authenticity would pervade teacher-pupil interactions and that a

humanistic pupil control orientation would facilitate and be facilitated by authentic interactions between teachers and pupils. The results support this explanation. Schools with open climate were significantly more humanistic in their pupil-control orientations.

Several studies (Coleman et al., 1966; Heath, 1970; Diebert & Hoy, 1972) have underscored both the atmosphere of the school and the students' sense of involvement and identification with school as salient factors in students' growth and development. That evidence, together with the results of the present research, suggests the potentially important role of principal authenticity in the development of healthy organizational dynamics; in fact, the success of any strategy for changing the climate of an elementary school seems limited unless the pivotal importance of the principal's leadership role is recognized. The findings imply that authenticity on the part of the leader seems to foster authenticity among teachers which in turn may pervade teacher-pupil relations.

Finally, the confirmation of the first two hypotheses provide additional support for the construct validity of the Leader Authenticity Scale (LAS), and thus provides organizational researchers with a useful measure of a theoretically significant concept.

References

- Appleberry, J.B., & Hoy, W.K. The pupil control ideology of professional personnel in open and closed elementary schools. *Educational Administration Quarterly*, 1969, 5, 74-85.
- Andrews, J. School organizational climate: Some validity studies. *Canadian Education and Research Digest*, 1965, 5, 317-333.
- Carlson, R.O. Environmental constraints and organizational consequences; the public school and its clients. In D.E. Griffiths (Ed.), *Behavioral science and educational administration*. Chicago: University of Chicago Press, 1964.
- Coleman, J.S., Campbell, E.Q., Hobson, C.J., McPartland, J., Mood, A.M., Weinfeld, F. D., and York, R.L. *Equality of educational opportunity*. Washington, D.C.: U.S. Government Printing Office, 1966.
- Deibert, J.P., & Hoy, W.K. Custodial high schools and self-actualization of students. *Educational Research Quarterly*, 1977, 2, 24-31.
- Fromm, E. *Man for himself*. New York: Farrar and Rinehart, 1948.
- Halpin, A.W. *Theory and research in administration*. New York: Macmillan, 1966.
- Halpin, A.W., & Croft, D.B. *Organizational climate of schools*. Chicago: Midwest Administration Center, University of Chicago, 1963.
- Hartley, M. and Hoy, W.K. Openness of school climate and alienation of high school students. *California Journal of Educational Research*, 1972, 23, 17-24.
- Heath, D.H. Student alienation and school. *The School Review*, 1970, 78, 515-528.
- Henderson, J.E., & Hoy, W.K. Leader authenticity: The development and test of an operational measure. New York, AERA paper, 1982.
- Hoy, W.K. The influence of experience on the beginning teacher. *The School Review*, 1968, 76, 312-323.
- Hoy, W.K. Dimensions of student alienation and characteristics of public high schools. *Interchange*, 1972, 3, 38-52. (a)
- Hoy, W.K. Some further notes on the OCDQ. *The Journal of Educational Administration*, 1972, 10, 46-51. (b)
- Hoy, W.K., & Miskel, C.G. *Educational administration: Theory, research, and practice*. New York: Random House, 1978.

Waller, W. *The sociology of teaching*. New York: John Wiley and Sons, 1932.

Willower, D.J., & Jones, R.G. When pupil control becomes an institutional theme. *Phi Delta Kappan*, 1963, 45, 107-109.

Willower, D.J., Eidell, T.L., & Hoy, W.K. *The school and pupil control ideology*. University Park: Pennsylvania State University, 1967.

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Psychosocial Correlates of Dropout and Achievement in an Adult High School Completion Program

Little is known about the true relationship of nonschool variables and adult learner dropout. The purpose of this research was to determine the relative effects of socioeconomic and psychological factors upon dropout. In this study, the Differential Aptitude Test, the Tennessee Self Concept Scale, the Social Readjustment Rating Scale, the Adjective Check List, and a measure of perceived financial concern were administered to 92 adult high school completion students. Two sets of analyses were performed using persistence/dropout and achievement as dependent variables. The best significant predictor of dropout was found to be the Social Readjustment Rating Scale while the only significant predictor of achievement was the Differential Aptitude Test. The results were discussed regarding possible theoretical implications, variance explained, and limitations of the study.

When adults are asked why they dropped out of a formal learning setting, the typical reasons given are related to financial, social, and health problems. This is perhaps not surprising considering that some of the more apparent characteristics of adulthood are the roles and responsibilities assumed during the adult stages of life. However, these reasons are often seen as ego-sustaining rationalizations. Some researchers studying adult learner dropout downplay or reject outright such factors as valid reasons (Boshier, 1972; Miller, 1970; Zahn, 1964). Unfortunately, due primarily to methodological deficiencies, the true influence of socioeconomic factors upon dropout has yet to be adequately assessed.

The most serious of these deficiencies is that dropout studies have usually been conducted after attrition has occurred. This has left the findings open to the

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charge that most nonschool reasons for dropout are rationalizations and that such factors are relatively minor irritants that simply trigger dropout. A second deficiency of much research into dropout concerns the study of one or two variables, or at best, a cluster of highly correlated variables. In this way the predictive power of a variety of variables cannot be determined.

The importance of a particular variable on dropout can only be properly determined in relation to other variables. The complex interrelationships of the many variables involved necessitates a perspective that views the adult learner in a more holistic manner such that the effect of variables relative to, and in combination with other variables, may be determined. In particular, the prediction and control of dropout in adult education remains at an embryonic stage because of the complexity of adult learner behavior, the fragmented approach to studying the problem, and the overdependence upon univariate designs.

The main purpose of this study was to determine which of a set of psychosocial variables significantly discriminated between persisters and dropouts in an adult high school completion program. An additional purpose was to determine which of the same set of independent variables best predicted achievement for the persisters.

Design

Instrumentation

The instruments used were the Differential Aptitude Tests: Verbal Reasoning (Bennett et al., 1972), Tennessee Self Concept Scale (Fitts, 1965), Social Readjustment Rating Scale (Holmes & Rahe, 1967), Adjective Check List (Gough & Heilbrun, 1980), and a subjective rating scale of perceived financial concern. The Differential Aptitude Tests: Verbal Reasoning (DAT) purports to measure how well an individual can understand, think, and reason verbally. Several dimensions of self-concept derived from both internal and external frames of reference were measured by the Tennessee Self Concept Scale (TSCS). The Adjective Check List (ACL) measures the expressed needs of the individual and the individual's personality and social dispositions. An instrument consisting of Likert-type scales was used to elicit responses regarding financial concern.

The independent variables were selected from the scales and subscales of the above instruments. Inclusion of all the subscales was impossible because of limitations due to sample size. The rationale for selection was based primarily upon previous research findings. The three major subscales of the TSCS were used in the analysis. They were identity, self-satisfaction, and behavior. In addition, achievement need, endurance, and self-control were three variables selected from the ACL. A description of the nine variables used in the analysis follows:

1. DAT: the DAT purports to measure how well an individual can understand, think, and reason verbally, as well as being a good predictor of educational performance.
2. SRRS: the SRRS is a measure of recently experienced life changes that results in stress. Examples of such changes are a family death, financial commitment, and job change.
3. Financial Concern: this instrument assesses the perceived degree of financial concern.
4. Identity: a subscale of the TSCS which reflects how an individual sees himself regarding his basic identity.

5. Self-satisfaction: this TSCS subscale measures the level of perceived acceptance.
6. Behavior: this TSCS subscale measures individuals' perceptions of how they act.
7. Achievement Need: a subscale of the ACL which assesses the need to strive and live up to socially recognized performance.
8. Endurance: the persistence in a task undertaken is measured by this ACL subscale.
9. Self-control: this variable is also an ACL subscale where the high scorer can be typified as being responsible and diligent while the low scorer is self-centered and expressive.

Reliability and Validity

Split-half reliability coefficients of the DAT: Verbal range from .90 to .95. Validity correlation coefficients show the DAT: Verbal to be a very good predictor of educational performance. Test-retest reliability coefficients for the major subscales of the TSCS are all over .90. Construct validity was determined through unanimous agreement by judges that items were classified correctly. The test has also been validated using discrimination among groups, correlation with other personality measures, and personality changes under particular conditions. The ACL median alpha reliability coefficients for males was .76 and .75 for females. The construct validity of this test was based upon correlations with external or nontest criteria as well as inferred psychological meaning. The financial concern questionnaire was pilot tested and eight items were retained having a Hoyt's reliability estimate of .95. Content validity, assessed by judges, was determined to be high.

Sample and Administration

Ninety-two adult learners enrolled in tenth grade English and math courses comprised the sample. These courses were part of a high school completion program designed for students who were either 18 years of age or older or who had been out of school at least one full year.

The instruments were administered during the third class of the spring semester, 1981. The five instruments took approximately 1½ hours to administer and were given in the following order: SRRS, financial concern, ACL, TSCS, and the DAT.

Analysis

The dependent variables of the two sets of analyses were persistence/dropout and achievement. Dropouts were those students who did not receive a grade at the end of the course and were classified as incomplete. Achievement was measured by means of six letter grade categories used by the institution and was considered to be a continuous variable since gradations of achievement were apparent. Within class standardized scores were used in all analyses in order to eliminate between class variance differences.

The ability of the nine independent variables to discriminate between persisters and dropouts was tested using the Statistical Package for the Social

Sciences (Nie et al., 1975) discriminant analysis program. This program uses a stepwise solution which selects variables on the basis of their discriminatory power.

Multiple regression analysis was used to determine whether the nine independent variables could significantly predict achievement for the persister. This was tested using the Statistical Package for the Social Sciences (Nie et al, 1975) multiple regression program. The program employs a stepwise solution which selects variables based upon an inclusion significance criteria.

TABLE 1
MEANS AND STANDARD DEVIATIONS
OF PREDICTOR VARIABLES FOR CRITERION GROUPS

Predictor Variable	Persister (58)	Dropout (34)
1. DAT		
Mean	-.0937	.1599
Std. Dev.	1.0169	.8822
2. SRRS		
Mean	-.2150	.3667
Std. Dev.	.8407	1.0796
3. Financial Concern		
Mean	-.0592	.1010
Std. Dev.	.9466	1.0206
4. Identity		
Mean	.1152	-.1966
Std. Dev.	.8443	1.1453
5. Self-Satisfaction		
Mean	.0663	-.1132
Std. Dev.	.9084	1.0769
6. Behaviour		
Mean	.0050	-.0085
Std. Dev.	.9681	.9936
7. Achievement Need		
Mean	-.0144	.0245
Std. Dev.	.9115	1.0817
8. Endurance		
Mean	.1091	-.1861
Std. Dev.	.8669	1.1186
9. Self-Study		
Mean	.1959	-.3343
Std. Dev.	.9645	.9037

Note: Group size is shown in brackets

Results

Persistence/Dropout

The focus of this analysis was upon the ability of the nine independent variables to discriminate between persisters and dropouts. Predictor variable

means and standard deviations are reported separately in Table 1 for the persister and dropout groups. The intercorrelation matrix for the nine predictor variables is shown in Table 2. Two discriminant analyses were performed. The first analysis allowed all the variables to enter, which yielded an assessment of the relative contribution of each variable to the discrimination of persisters and dropouts. In the second analysis, only those variables which contributed significantly ($p<.05$) to the discrimination were retained. Thus a more parsimonious solution was obtained.

TABLE 2
INTERCORRELATIONS OF THE PREDICTOR VARIABLES

	DAT	SRRS	Financial Concern	Identity	Self- Satis- faction	Behavior	Achievement Need	Endurance	Self- Control
DAT	1.00								
SRRS	.11	1.00							
Financial Concern	-.17	.19	1.00						
Identity	.19	-.07	-.21	1.00					
Self- Satisfaction	.08	-.10	-.21	.62	1.00				
Behavior	.01	.09	-.07	.72	.62	1.00			
Achievement Need	.04	-.07	-.04	.43	.48	.37	1.00		
Endurance	.02	-.14	-.02	.37	.51	.52	.71	1.00	
Self- Control	.00	.07	.11	.07	-.05	.19	-.16	.24	1.00

The results of the first analysis allowing all variables to enter are given in Table 3. The independent variables are listed in order of their discriminating power along with the corresponding value of Wilks' lambda and significance level for each step. The two most powerful discriminators were the SRRS (life changes) and self-control. The remaining variables did not significantly increase discrimination as indicated by the significance levels. The persistence/dropout variance explained by all the variables was 20.9 percent.

When the significance criterion ($p<.05$) for additional discriminatory power was applied, only the SRRS and self-control variables were retained. The summary of the second analysis can be found in Table 4. It is interesting to note here that 15.2 percent of the variance was explained by these two variables.

By using the discriminant function to predict group membership for those students used to derive the function, an additional discrimination assessment was made. Classification results for both analyses are reported in Table 5. Results indicated that 63 percent of the subjects were classified correctly when all variables were included in the discriminant function and increased to 68.5 percent for the second analysis. Prior probabilities for classification purposes were set at .5.

TABLE 3
ORDER OF ENTRY OF INDEPENDENT VARIABLES
(ANALYSIS ONE: NO CRITERION)

Step	Independent Variable	Wilks' Lambda	Significance
1	SRRS	.9157	.0050
2	Self-Control	.8474	.0006
3	Identity	.8379	.0013
4	Behavior	.8220	.0017
5	DAT	.8066	.0021
6	Endurance	.8035	.0041
7	Achievement Need	.7927	.0054
8	Self-Satisfaction	.7913	.0099
9	Financial Concern	.7907	.0176

TABLE 4
SUMMARY STATISTICS: DISCRIMINANT ANALYSIS
(ANALYSIS TWO: SIGNIFICANCE CRITERION)

Independent Variable	Standardized Discriminant Function Coefficients
SRRS	.7646
Self-Control	-.7007
Eigenvalue	.1801
Canonical Correlation	.3907
Significance	.0006

Achievement

The second purpose of this study concerned the ability of the nine independent variables to predict persister achievement levels. As was done previously, two analyses were performed. The first multiple regression analysis allowed all the variables to enter giving an assessment of the relative contribution of each of the variables. This was followed by a stepwise multiple regression with the criterion that only those variables which contributed significantly ($p<.05$) to the prediction of achievement were retained.

Having allowed all the independent variables to enter the regression equation yielded the results found in Table 6. The variables are listed in order of their additional contribution to the prediction of achievement. The best predictor was the DAT. The second analysis using the significance criterion for additional predictive power allowed only the DAT to be included. The achievement variance explained by all the variables was 26.8 percent while the DAT by itself accounted for 7.5 percent of the variance.

TABLE 5

CLASSIFICATION RESULTS FOR PERSISTERS/DROPOUTS

	Actual Group Membership	Number of Subjects	Predicted Group Membership	
			Persisters	Dropouts
<u>First Analysis:</u>				
<u>No Criterion</u>				
	Persister	58	67.2% (39)	32.8% (19)
	Dropout	34	44.1% (15)	55.9% (19)
Percent classified correctly: 63%				
<u>Second Analysis:</u>				
<u>Significance Criterion</u>				
	Persister	58	69.0% (40)	31.0% (18)
	Dropout	34	32.4% (11)	67.6% (23)
Percent classified correctly: 69%				

Note: Number of subjects are in brackets.

TABLE 6

REGRESSION ANALYSIS SUMMARY

Step	Independent Variable	Squared Multiple Correlation	F Ratio	F Prob.
1	DAT	.0748	4.53	.038
2	Endurance	.1225	3.84	.028
3	Financial Concern	.1630	3.51	.021
4	SRRS	.2101	3.52	.013
5	Self-Satisfaction	.2438	3.35	.011
6	Achievement Need	.2667	3.09	.012
7	Self-Control	.2673	2.61	.023
8	Behavior	.2675	2.24	.040
9	Identity	.2680	1.95	.067

Discussion

The findings of the discriminant analysis have shown that of the variables considered, life change (SRRS) was the best predictor of dropout. The other significant predictor was found to be self-control which was characterized (on the positive pole) as representing responsibility, diligence, and patience. The results of the multiple regression analysis in predicting persister achievement indicated that the DAT was the only significant predictor.

Considering the dependent variable persistence/dropout, the important finding was that dropout appears to be strongly influenced by environmental factors. This

is reflected in the fact that life change is a significantly better predictor of dropout than self-concept measures or cognitive aptitude, as previous research (Boshier, 1972; Zahn, 1964) has suggested. The implication of this finding is that perhaps when adult learners say they dropped out for family, health, or economic reasons they may not be simply invoking ego-sustaining rationalizations.

The results of the analysis of both dependent variables for this sample of students indicated that persistence/dropout and achievement are two relatively distinct phenomena. In fact, it appeared that dropout is influenced more by environmental concerns while achievement is related to cognitive ability. If these results are valid, there exists a close parallel to Herzberg's (1967) theory of motivation in the work setting. Herzberg states that factors which contribute to job satisfaction are distinct from those which contribute to job dissatisfaction. He suggested that dissatisfiers include environmental variables which are either neutral or impediments to doing a task, whereas satisfiers are those variables which relate to the performance of a task. If dropout was to be considered a reflection of dissatisfaction and achievement was associated with satisfaction, then the results of this study correspond very well to Herzberg's theory when applied to the adult learning setting. It may be that a similar theory could be useful in understanding adult dropout and achievement.

Another point of discussion concerns the persistence/dropout variance explained by the predictor variables. It should be emphasized that, although a relatively small amount of variance was explained, this was not inconsistent with previous research (Anderson & Darkenwald, 1979; Knox & Sjogren, 1965). Perhaps one explanation for this is that a large number of variables may combine in unique ways to cause dropout. Not only may the critical combination of variables be unique to each individual but they are certain to change over time. This necessitates a much broader perspective of the adult learner. Factors outside the context of the formal learning setting must be seriously considered if the understanding and prediction of adult dropout is to be improved. In addition the effect over time of both school and nonschool factors must be studied.

The results of this study have revealed several significant relationships; however, because of the selection and size of this sample, extreme caution must be exercised in attempting to generalize these findings. It is therefore necessary that replication studies within other institutions and across various educational levels be conducted. Financial support for the project was provided through a grant from the Educational Research Institute of British Columbia.

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References

- Anderson, R., & Darkenwald, G. *Participation and persistence in American adult education*. New York: College Entrance Examination Board, 1979.
- Bennett, G., et al. *Differential Aptitude Tests: Verbal Reasoning (Form T)*. New York: The Psychological Corporation, 1972.
- Boshier, R. The development and use of a dropout prediction scale. *Adult Education*, 1972, 22(2), 87-89.
- Fitts, W. *Tennessee Self Concept Scale*. Nashville: Counselor Recordings and Tests, 1965.
- Gough, H., & Heilbrun, A. *The Adjective Check List*. Palo Alto: Consulting Psychologists Press, 1980.

- Herzberg, F. *The motivation to work*. New York: John Wiley & Sons, Inc., 1967.
- Holmes, T., & Rahe, R. The Social Readjustment Rating Scale. *Journal of Psychosomatic Research*, 1967, 11, 213-218.
- Knox, A., & Sjogren, D. Achievement and withdrawal in university adult education classes. *Adult Education*, 1965, 15(Winter), 74-88.
- Miller, G. *Success, failure, and wastage in higher education*. London: George G. Harrap & Co. Ltd., 1970.
- Nie, N., et al. *Statistical package for the social sciences*, (2nd ed.). New York: McGraw-Hill, 1975.
- Zahn, J. Dropout and academic ability in university extension courses. *Adult Education*, 1964, 15(1), 35-46.

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Solving Textbook Mathematical Word Problems

The results of the last two British Columbia Mathematics Assessments demonstrated that a drastic differential in performance existed among elementary school students with respect to solving multi-step mathematical word problems as opposed to one-step problems.

Two groups of nine students were formed such that every student had a perfect score on one-step problems and yet one group's score on multi-step problems was over twice as great as the other group. The subjects were interviewed in a situation where they solved problems from elementary school mathematics materials. Some of the results from the protocol analysis were that the students tended to "skim" for facts rather than re-read the problems which led to 40% of the multi-step problems being treated as one-step problems, that students did not check either their work or their final answer, and that either the students were inexperienced with heuristics (other than Uses Algorithms) or elementary textbook story problems do not require the use of other heuristics for solution.

This article concerns grade 7 students solving grade 7 level word problems from grade 7 level materials. The problems are not unusual and the problems are routine.

If one defines "problem solving" in the classical sense that there are three conditions:

1. The individual has a clearly defined goal of which he is consciously aware and whose attainment he desires.

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2. Blocking of the path toward the goal occurs, and the individual's fixed patterns of behavior or habitual responses are not sufficient for removing the block.
3. Deliberation takes place. The individual becomes aware of the problem, defines it more or less clearly, identifies various possible hypotheses (solutions), and tests these for feasibility. (Henderson & Pingry, 1953, p. 230)

then this is an article on problem solving. When one looks at the results one realizes "blocking" should have occurred but did not.

The current study was designed to look at problem solving as it relates to solving certain types of word problems found in elementary school mathematics materials. Mathematics teachers at every level are depending on textbooks and their most frequent use of their textbook is as a source of problems, according to the results of the 1977 B.C. Mathematics Assessment (Robitaille & Sherrill, 1977b, pp. 42, 44, 45). The decision to look at textbook word problems was originally based upon the results of the 1977 B.C. Mathematics Assessment. The results of the most recent B.C. Mathematics Assessment (1981) supported the decision.

One of the disturbing results of both the 1977 and the 1981 B.C. Mathematics Assessments was the differential performance of students on one-step and multi-step mathematical word problems.

A one-step mathematical word problem is a problem that can be solved by combining the given numbers using one operation. A multi-step mathematical word problem is, of course, a problem requiring more than one step for solution. There are, however, many types of multi-step mathematical word problems.

Two types of multi-step problems were used in the study. The first type was word problems where one must combine the given numbers, but using more than one operation. The other type was word problems where one must generate from the given numbers another number which is required for the solution.

On the B.C. Mathematics Assessment test given to the Grade 8 students (grades K - 7 are in the elementary schools in B.C.) in 1977 there were three items the author categorized as one-step problems and six items categorized as multi-step problems. The average performance on the one-step problems was 73.3%; the average performance on the multi-step problems was 44.8% — a differential in performance of 28.5%!

On the B.C. Mathematics Assessment tests given to Grade 8 students in 1981 there were 10 items of each type of problem. The differential in performance was 25.9%.

From the results of the B.C. Mathematics Assessment it appeared that there existed a sizable group of elementary school students who were good at solving one-step mathematical word problems while at the same time poor at solving multi-step mathematical word problems. The present study is an investigation of that phenomenon.

To achieve the purposes of the study two groups of students were interviewed in a problem-solving situation. Protocols were created from the interviews, analyzed, and compared.

Method

Subjects

The grade level selected for the study was Grade 7 since it represents the final year of the elementary mathematics curriculum in B.C. and, therefore, the most

mature elementary students with the greatest proficiency with the four basic operations.

Since the "think aloud" interview technique was to be used with the final sample of students, it was necessary that the size of the sample be kept small. However, the process of identifying the type of student needed for the interview required testing many students. The criteria each student had to pass to remain for possible selection for the interview groups are shown in Figure 1.

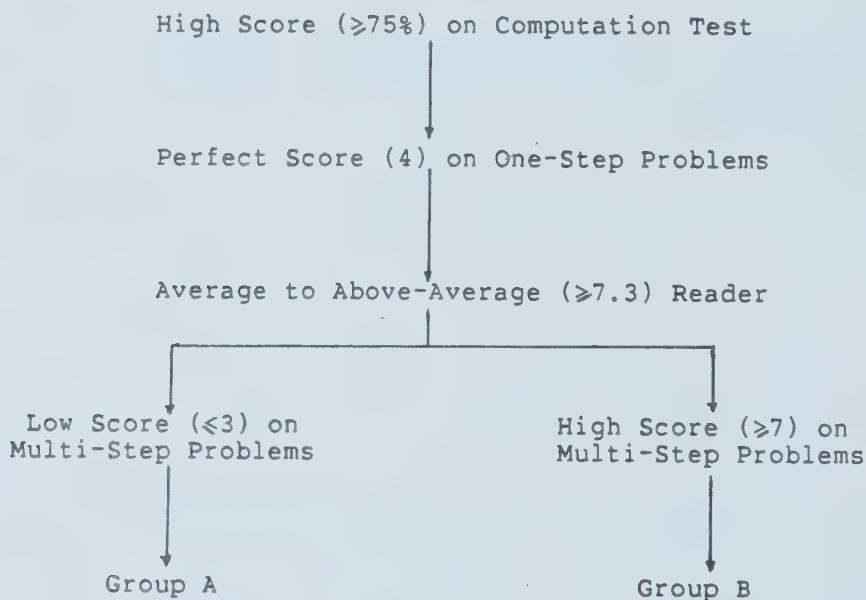


Figure 1. Criteria for group membership.

The original sample consisted of all 283 grade seven students in the seven elementary schools involved in the study. The interview sample consisted of two groups of 9 subjects each. The method for going from 283 students to 18 students is presented in the Procedure section.

Instruments

Two problem-solving tests and a computation test were developed. The initial problem-solving test consisted of 12 items (a one-step problem, and two multi-step problems for each of four different physical settings). The second problem-solving test contained 9 problems, a one-step problem and two multi-step problems for each of three different physical settings. A 42-item computation test was created based on the computation required to solve the word problems.

Over 600 word problems were collected from grade 7 materials. All items were screened on three criteria:

1. From the original item both a one-step and the multi-step problems could be created.
2. All three forms of the item could be worded in the same physical setting.
3. All three forms of the item were appropriate for the grade 7 level.

Looking at the criteria listed above it should be noted that there was no attempt to search out novel problems or problems that facilitate the use of specific heuristics. For many problem-solving studies the lack of such criteria

would be a weakness. For the present study, however, the problems were to be ones found in regular grade 7 materials.

One hundred and twenty items were field-tested and 36 (three forms of each of twelve word problems) were selected. The descriptive statistics for the computation test and the problem-solving test used in the selection of subjects are presented in Table 1.

TABLE 1
DESCRIPTIVE STATISTICS FOR THE TESTING INSTRUMENTS

Instruments	Number Of Items	Mean	Standard Deviation	Reliability
Computation Test	42	32.1	5.7	0.85
Problem-Solving Test	12	7.1	2.7	0.71
One-Step Problems	4	3.1		
Multi-Step Problems	8	4.0		

Procedure

The first part of the study was to create the interview groups. The data in Table 2 describe the order in which the criteria were applied and the successive elimination of subjects.

TABLE 2
CRITERIA USED TO CREATE THE INTERVIEW GROUPS

Criteria	Number of Subjects Eliminated	Number of Subjects Remaining
Original Sample	---	283
Complete Data	18	265
Perfect Score on	149	116
One-Step Problems		
Score of 30 or More	41	75
on Computation Test		
Reading level ≥ 7.3	21	54
Scores of 0-3 or 7-8	25	29
on Multi-Step Problems		

Based on discussions with colleagues involved in interview research it was decided that 15-20 interviews were all that could be analyzed in the time period allowed. Two groups of nine students each were created from the 29 students that remained.

The sole basis for selection of the final 18 subjects from the remaining 29 was each subject's score on the multi-step problems. The subjects with the 9 lowest scores became group A and the subjects with the 9 highest scores became group B. As one can see from Table 3, however, *both* groups averaged 35 (83%) on the computation test, *both* groups have high reading levels (over one grade level above average), *every* member of both interview groups scored perfect on the one-step

problems (which was required), and yet, one group scored over twice as high as the other group on the multi-step mathematical word problems.

TABLE 3
CRITERIA SCORES FOR THE TWO INTERVIEW GROUPS

	Computation Test	Reading Level	One-Step Problems	Multi-Step Problems
Group A	35.0	8.7	4.0	3.0
Group B	35.0	8.7	4.0	7.1

The second part of the study was the interview. The interviews were scheduled by the school in consultation with each student interviewed, each student's teacher, and the interviewer. The interviewer was the same person who created the protocols. Neither the interviewer nor the author, who analyzed the data, knew to which group any subject belonged. Grouping the data and the analysis of the protocols by Group A and Group B was one of the final steps of the study.

The interview included the subject solving six problems (one of each type of problem for each of two physical settings). The interviews made use of the "think aloud" procedure. The procedure has been used in similar research studies most notably by Krutetskii (1976), Menchinskaya (1969), Kantowski (1974), Blake (1976), and Kilpatrick (1967). Since the "think aloud" procedure was used, the interviewer had several warm-up problems available to use with the students to get them to think aloud.

The protocols consisted of a typed transcript of the entire interview.

The problems (See List of Problems) were presented one at a time. Based on the results of a pilot study, it was decided that each subject would be presented with only 6 of the 9 problems. The problems were arranged in cycles so that each subject faced 6 problems. In each cycle a one-step problem appeared first, then two of the first type of multi-step problems followed by the other one-step problem then two of the other type of multi-step problems.

Results

The problems were labeled ABC-DEF-GHI, where each triple represents one physical setting. The first problem in each triple is the one-step problem.

The success of the students on each item is presented in Table 4.

Given that the problems were of the type found in Grade 7 materials, it is not surprising that the success rate is higher than in many problem-solving studies in which novel and unusual problems are used. Given how Groups A and B were constructed it is also not surprising that Group B outperformed Group A. When the items are subdivided into one-step vs. multi-step problems, the definition of the two groups is upheld. On one-step problems Group B outperformed Group A by a very slight margin (18 to 16) while on the multi-step problems Group B had a very large advantage (31 to 21).

Overall, the subjects presented correct solutions to 34 of 36 instances of one-step problems and 52 of 72 instances of multi-step problems.

TABLE 4
STUDENT SUCCESS ON THE INTERVIEW PROBLEMS

Group A	P R O B L E M									Total
	A	B	C	D	E	F	G	H	I	
1	1*	1	1	1	1	1	-	-	-	6
2	1	1	1	1	1	1	-	-	-	6
3	1	0	0	1	1	0	-	-	-	3
4	1	0	0	-	-	-	1	1	0	3
5	1	0	0	-	-	-	0	0	1	2
6	0	0	0	-	-	-	1	1	0	2
7	-	-	-	1	1	1	1	1	0	5
8	-	-	-	1	1	1	1	1	0	5
9	-	-	-	1	1	0	1	1	1	5
Total	5	2	2	6	6	4	5	5	2	37
Group B										
1	1	1	1	1	1	1	-	-	-	6
2	1	1	1	1	1	1	-	-	-	6
3	1	1	1	1	1	1	-	-	-	6
4	1	1	1	-	-	-	1	1	0	5
5	1	0	1	-	-	-	1	1	1	5
6	1	1	1	-	-	-	1	1	0	5
7	-	-	-	1	1	1	1	1	1	6
8	-	-	-	1	1	0	1	1	1	5
9	-	-	-	1	1	1	1	1	0	5
Total	6	5	6	6	6	5	6	6	3	49

* 1 means the student solved the problem; 0 means the student did not solve the problem; - means the problem was not in the student's interview.

The data in Table 5 describe the amount of time spent in solving the word problems.

TABLE 5
AVERAGE TIME SPENT ON EACH PROBLEM
BY GROUP (IN SECONDS)

Group	P R O B L E M								
	A	B	C	D	E	F	G	H	I
A	137	133	153	53*	88	120*	112	124	216*
B	68*	71*	99*	57	69	95	65	131*	123

* Computed after eliminating outlying times. Outlying times had to exceed the next greatest time by 200 seconds or more.

As explained in the footnote with Table 5, four problems in Group B and 3 problems in Group A had outlying times. An outlying time was defined to be a time that exceeded the next greatest time by 200 seconds. The outlying times were caused by the student either trying repeatedly to use an incorrect arithmetic

algorithm or trying to get a solution based on a prior problem of the same physical setting. The first reason offered no discernible insights into the solution process and the second reason is discussed later. In five of the seven cases there was only one item that required more time than 200 seconds and it was 200 seconds above the next greatest time. Interestingly enough, six of the seven students with outlying times solved the problem! On the one problem that had an outlying time and was not solved, the student spent almost half an hour (1694 seconds) searching for a solution. Since such extreme times do give an inflated mean (and the median would yield little information when dealing with time), the outlying times were eliminated *before* computing the average time spent on a problem.

It is also interesting that only one student missed Problem A and only one person missed Problem G, yet it took Group A almost twice as long to solve the two problems as Group B.

The descriptive statistics given thus far should be ample reminder that this study deals with solving word problems that grade 7 students normally confront, not novel or unusual problems.

The following results deal with the procedures the subjects used for solving the type of word problems they find in their textbooks.

Reading the Problem

Students were required to read the problem to begin their work. The data in Table 6 represent the number of times each problem was *re-read* by the two groups. Each problem was read by six students.

TABLE 6
NUMBER OF TIMES EACH PROBLEM WAS REREAD

Group	P R O B L E M								
	A	B	C	D	E	F	G	H	I
A	2	6	12	3	2	4	4	6	8
B	3	2	5	2	0	1	1	6	0

The three most difficult items (I, B, and C) were three of the four most re-read items. The problem re-read second most often was Problem H, which only one person failed to solve. Half of the Group B students who worked on Problem I missed it, but no one re-read the problem. The most commonly re-read problem (Problem C) yielded a median of only 1.17 re-readings.

Number of Re-attempts

The number of times a student attempted each problem was tallied. Since each student attempted each problem at least once, the data in Table 7 represent the number of re-attempts, defined to be situations where a student starts working on a problem again from a beginning step.

TABLE 7
NUMBER OF REATTEMPTS BY GROUP

	P		R	O	B	L	E	M	
Group	A	B	C	D	E	F	G	H	I
A	5*	3	2*	0	0	0	0	0	0
B	2	4	2	3*	1	1	2*	0	7

*All re-attempts by the same student.

Of the 17 problems missed by Group A students, only 7 were attempted more than once. Of the 5 problems missed by Group B students, *none* were attempted more than once.

Since the author would rather run the risk of being accused of going beyond the data than avoiding using the quality of the data to make a statement, a conclusion will be reported here. In almost all cases where a student reported an incorrect result but did not re-attempt the problem, the cause seemed to be that he felt his technique was correct therefore his result was correct. This was true even when it was obvious he had little faith in the correctness of his result.

Arithmetic

The two groups averaged 83% on the test covering the arithmetic involved in solving the word problems. However, it is still quite surprising that of the 22 problems missed, only 3 solutions involved computational errors. A much greater problem was not knowing the numbers and/or operations with which to apply their computational skill.

Checking Answers

After obtaining an answer for a problem, conventional wisdom says students should be encouraged to check their answers. Each group faced 54 problems (6 problems x 9 students). Of the 54 problems faced by Group A students, 2 were checked; of the 54 problems faced by Group B students, 9 were checked. All 11 problems for which solutions were checked were eventually solved correctly.

Heuristics

The largest segment of the current research in mathematical problem solving deals with the use of heuristics. The protocols were analyzed for occurrences of the eight most commonly observed heuristics (based on a survey of the research literature by I. Isaacs of the University of the West Indies and verbally communicated to the author in a faculty seminar). The eight heuristics are as follows:

- Draws Diagrams
- Trial and Error
- Recalls Related Facts
- Recalls Related Method
- Uses Mnemonics and Equations
- Uses Algorithms
- Examines Special Cases
- Successive Approximations.

Draws Diagrams: The types of problems involved in the interviews were not types that would generate diagrams so it isn't surprising that no diagrams were drawn. Three students did, however, represent the problem in a visual form by arranging the data in a table.

All three tables were constructed for the data in Problem H. All three students were successful in attaining the correct solution, but only one person interviewed was not successful on Problem H.

Trial and Error. One characteristic usually attributed to good problem solvers is the tendency to use numeric examples to try to gain some understanding of the structure of the problem situation.

Not a single instance of trial and error was observed in the interviews. Again, one could argue the problem types eliminated this heuristic as a viable approach. In the adult view of the problems, however, the opportunity for using trial and error existed.

Recalls Related Facts. There were five instances where the problem solution was developing slowly until the student remembered a specific fact that was related to the problem situation. In all five cases the student was trying to solve the second type of multi-step problem. In four of the five cases the student recalled a specific number that was required (but not given) for the solution.

Recalls Related Method. Although the students were forewarned and reminded of the warning that no two problems were the same, the students were very concerned about problems having the same physical setting. Each student faced six problems, 3 each of 2 different physical settings. Some students tried to recall how they solved the last one of the same setting.

There were 3 problems for each physical setting used. All 3 problems used very similar wordings (see List of Problems). For problems A, B, and C, for example, there were 26 instances of students actually saying something like "I'm trying to remember how I solved the last contractor problem."

Uses Mnemonics and Equations. There was only one attempt to try to introduce symbolism into the solution. It should be added that few textbook problems require such an approach except for problems that are in the book for that very purpose.

Uses Algorithms. This is where the emphasis is undoubtedly being placed in problem-solving strategies in the public elementary schools. By far the most common approach was to read the problem for the key word(s) (word[s] that directs one to the proper operation), select the algorithm based on the key word, apply the algorithm.

The use of this heuristic was unanimous. The technique has strengths and weaknesses. Three strengths certainly are that it is easy to teach, easy to apply, and very successful with one-step problems. The weaknesses that appeared in the current data are presented at the beginning of the Discussion section.

Examines Special Cases: No one used this heuristic.

Successive Approximations. No one used this heuristic.

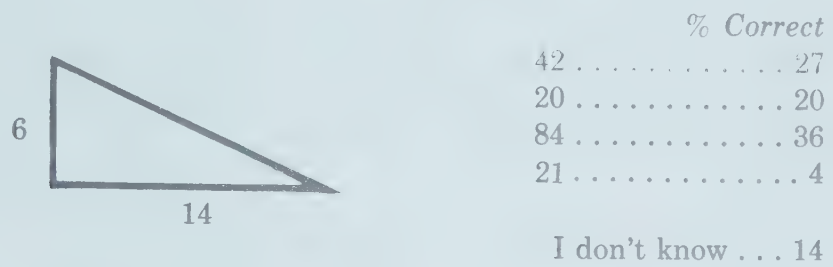
Of the eight most commonly observed heuristics in previous research studies only one was observed to any great extent and that was Uses Algorithms. Again, any set of problems will have characteristics that obviate the use of certain heuristics. It may not be that the subjects involved in the study do not have all

eight heuristics in their repertoire; it may be that the problems found in current elementary school mathematics materials do not require such heuristics for solution.

One-Step - vs - Multi-Step Problems .

The problem below is from the 1981 B.C. Mathematics Assessment.

40. Find the area of this right triangle.



While only 27% of the students solved the problem correctly, 56% of the students treated the item as a one-step problem. Thirty-six percent of the students multiplied the two given numbers and stopped; another 20% of the students added the two given numbers and stopped. Had this had been a problem of finding the area of a rectangle the 36% selecting 84 would have been counted as correct, but, perhaps, for the wrong reasons.

Of the ten multi-step problems on the 1981 B.C. Mathematics Assessment instrument, incorrect responses on six of the items appear to have been the direct result of students treating the problems as one-step problems. On four of the six problems more students selected the one-step answer than selected the correct answer. Of the 20 Incorrect solutions to the multi-step problems involved in the interviews, 8 were a result of treating a multi-step problem as a one-step problem.

Discussion

As with other studies of the present type the richness of the data provides more results and trends than can be presented in one article. The full report is listed in the references. In this section only four results will be discussed.

- A. As mentioned toward the end of the last section, the students demonstrated one pervasive problem-solving strategy;
 - 1. Search for key words.
 - 2. Select the algorithm based on the key words.
 - 3. Apply the algorithm.

The use of such an approach was unanimous. The technique has strengths and weaknesses. The strengths were discussed earlier; based on the data from the present study the weaknesses are:

1. The student can identify key words, but select either the wrong algorithm or the wrong *sequence* of algorithms (7 instances).
2. The student can identify key words, select the proper algorithm, but use the wrong numbers (9 instances).
3. The student can identify key words, select the proper algorithm, apply the algorithm properly, and stop, not realizing the problem was a multi-step problem (8 instances).

In the view of this researcher, it is weakness #3 that is instrumental in the drastic differential in performance between one-step and multi-step mathematical word problems demonstrated in the two B.C. Mathematics Assessments. Using such a problem-solving strategy, a student can find a key word, select the algorithm suggested by the key words, apply the algorithm, and get an answer. The answer, the algorithm, and the key words will all match, but the answer is only one part of the problem. Forty percent of the incorrect solutions to the multi-step problems were incorrect because the students treated the problems as one-step problems!

Searching for key words (clue words or phrases) is still an important method for determining any computational algorithms that may be needed to solve a word problem found in elementary school mathematics textbooks, but there is a caution. Once the key words are found the students should be encouraged to re-read the *entire* problem to put the key words into the context of the entire problem.

- B. The students simply did not check their answers. Of the 108 problems used in the interviews, 11 were checked! Of the 11 problems checked, all were solved; so, of course, of the 22 problems worked incorrectly, none were checked. The data suggest strongly that students must be convinced of the importance of checking their work and the final solution.
- C. Putting "Uses Algorithms" aside, the student made little use of the heuristics that have been observed in mathematical problem-solving research. One could jump to the conclusion that the teacher is at fault for students not experiencing the use of heuristics in their classes; however, it may be that those things called "story problems" in elementary school mathematics textbooks simply do not require the use of heuristics other than Uses Algorithms for solution.
- D. Lastly, a positive note. The students were willing to persevere with any problem. Factors such as the problems being selected to be well within the ability level of the students, the arithmetic level being kept low, or even the pleasant manner of the interviewer may have been causes for the result, but the fact is every student worked on every problem. One student worked for almost half an hour on Problem I. That same student spent almost an hour on the six problems and missed only one.

Conclusions

Several disturbing findings were revealed in the interviews and subsequent protocol analysis. The students did not re-read the problems carefully, the students did not check their work or their answers, 40% of the multi-step problems that were missed were treated as one-step problems, and students used only one heuristic to any great extent.

More studies need to be done to try to discover if the root of some of the results is teacher-centred, textbook-centred, or student-centred. If the average teacher continues to be dependent upon the textbook as *the* source of problems and the textbooks fail to give students experience with multi-step problems and a variety of heuristics, then the next move is very different than if the source of the difficulty is teacher-centred or student-centred.

LIST OF PROBLEMS

- A: A contractor is paid \$18 000 in 12 equal payments (one each month). How much is the contractor paid each month?
- B: A contractor is paid \$18 000 in 12 equal payments (one each month). How much will the contractor have been paid in 5 months?
- C: In one year a contractor is paid \$18 000 in equal monthly payments. How much will the contractor have been paid in 5 months?
- D: A grade 7 class practised a school play for 75 minutes a day for 7 days. How many minutes did they practise the play?
- E: A grade 7 class practised a school play for 75 minutes a day for 7 days plus one final rehearsal of 90 minutes. How many minutes did they practise the play?
- F: A grade 7 class practised a school play from 3:30 p.m. to 4:45 p.m. each day for 7 days plus one final rehearsal of 90 minutes. How many minutes did they practise the play?
- G: In a discussion concerning summer activities a grade 7 class discovered that 14 of the students had spent their summer holidays in a Canadian province other than B.C., 8 had spent their holidays in the U.S., and 10 had spent their holidays in B.C.. How many spent their holidays in Canada?
- H: In a discussion concerning summer activities a grade 7 class discovered that 14 of the students had spent their summer holidays in a Canadian province other than B.C., 8 had spent their holidays in the U.S., and 10 had spent their holidays in B.C.. How many more spent their holidays in Canada than the U.S.?
- I: In a discussion concerning summer activities a grade 7 class discovered that 14 of the students had spent their summer holidays in a Canadian province other than B.C., 8 had spent their holidays in the U.S., and 10 had spent their holidays in B.C.. What fraction of the students spent their holidays in B.C.?

References

- Blake, R.N. *The effect of problem context upon the problem solving process used by field dependent and independent students: A clinical study*. Unpublished doctoral dissertation, University of British Columbia, 1976.

- Branca, N.A. Problem solving as a goal, process, and basic skill. In S. Krulik & R.E. Reys (Eds.), *Problem solving in school mathematics*. Reston, Virginia: The National Council of Teachers of Mathematics, 1980, 3-8.
- Goals for School Mathematics*. Boston: Houghton Mifflin Company, 1963.
- Henderson, K.B., & Pingry, R.E. Problem-solving in mathematics. In H.F. Fehr (Ed.), *The learning of mathematics its theory and practice*. Washington, D.C.: The National Council of Teachers of Mathematics, 1953, 228-270.
- Kantowski, E.L. *Processes involved in mathematical problem solving*. Unpublished doctoral dissertation, University of Georgia, 1974.
- Kilpatrick, J. *Analyzing the solution of word problems in mathematics: An exploratory study*. Unpublished doctoral dissertation, Stanford University, 1967.
- Kilpatrick, J. Problem solving in mathematics. Washington, D.C.: American Educational Research Association, *Review of Educational Research*, 1969, 39(4), 523-534.
- Krutetskii, V.A. *The psychology of mathematical abilities in school children*. (Edited by J. Kilpatrick & I. Wirszup.) Translated by J. Teller, National Science Foundation: Survey of Recent Eastern European Mathematical Literature, 1969.
- Menchinskaya, N.A. Fifty years of Soviet instructional psychology. In J. Kilpatrick & I. Wirszup (Eds.), *Soviet studies in the psychology of learning and teaching mathematics*. National Science Foundation: School Mathematics Study Group and Survey of Recent Eastern European Mathematical Literature, 1969.
- National Council of Teachers of Mathematics. *An Agenda for Action*, Reston Virginia: The National Council of Teachers of Mathematics, 1980.
- Robitaille, D.F. (Ed.) *British Columbia Mathematics Assessment 1981: General report*. Victoria, B.C.: Ministry of Education, 1981.
- Robitaille, D., & Sherrill, J. *B.C. Mathematics Assessment Report 1: Test results*. Victoria, B.C. Ministry of Education, 1977. (a)
- Robitaille, D., & Sherrill, J. *B.C. Mathematics Assessment Report 2: Instructional practices*. Victoria, B.C.: Ministry of Education, 1977. (b)
- Sherrill, J.M. *Solving multi-step mathematical word problems*. Report 80:18, Vancouver, B.C.: Educational Research Institute of British Columbia, 1980.

BOOK REVIEWS

INSTRUCTIONAL DESIGN FOR SPECIAL EDUCATION. *By David Baine.* Englewood Cliffs, NJ: Educational Technology Publications, 1982, 319 pp.

Professor Baine, of the University of Alberta, has written a practical book on instructional design and one which should prove useful both to practitioners in the field and those of us working in university and inservice settings. The book details the procedures for development of specific lessons and total units for handicapped learners. Drawing heavily on the research and programming style of Becker and Engleman's direct instruction, the material is clearest and best supported when dealing with basic skills and simple concepts. Readers looking for techniques for discovery learning, methods of affective education, or for academic discussions about the merits of one approach over another will be disappointed. Those looking for a concise source of detailed principles and procedures for the development of curriculum for severely impaired learners will find this an invaluable resource.

Each chapter is well organized with sufficient advance organizers, headings and subheadings, practice exercises, and vocabulary review to allow a student to work his or her way through with some degree of understanding and skill development, rather than merely reading it.

The text begins with a clear and extensive treatment of behavioral objectives and their development in specific education applications. The author includes the most detailed checklist I have seen for the writing and evaluating of behavioral objectives. His eight-stage model begins with a learner evaluation, prioritizing of goals, and a literature search of what is available. Following this, an analysis of the performance requirements of the objective is done, along with an analysis of any necessary learning "prosthetics." Only then does the author refer to the usual three elements of an objective: the performance, the conditions, and the standards.

Moving on to the difficult area of task analysis, Baine provides several examples and demonstrates several ways of organizing this process, along with another detailed checklist. Here he shows his debt to systems design principles in showing networking and in constructing a lattice of learning tasks. His hierarchic learning analysis is based primarily on Gagné and is well presented. A skill at developing a task analysis, while deceptively simple in concept, seems difficult to teach and I look forward to seeing how my students do with Dr. Baine's detailed and clear presentation.

In the next three chapters of the book, he explores and explains a great many applied learning principles in a fairly compact fashion. Relevant research is included and the chapters are clearly theoretically grounded but the emphasis remains on actually designing instructional sequences for real application. The approach is analytic, building learning from the bottom up, and providing as sophisticated a framework of supports as is needed for that learner. Included is consideration of forward and backward chaining, pacing, proactive and retroactive inhibition, prompting, cue fading, branching and looping and related concepts. The various methods of assuring motivation, including use of verbal, token, or

immediate reinforcers are considered here, along with the effects and role of various rates of reinforcement. Teachers meeting the educational problems of the handicapped for the first time will find these chapters a rich source of alternative ways to support learning.

Chapter six provides a worked example of an instructional design used by the author, bus travel for trainable mentally retarded young adults, which demonstrates the application of many of the principles discussed. Educators used to the relative paucity of detail in the typical lesson plans and instructional units may react to the amount of detail here, but teachers of the retarded will be struck by the level of success reported with this group.

Concept development is explored in further detail in the next two chapters, moving from discrimination learning of concrete concepts to sequences for concept formation. Again the strategies are specific, supported by research and detailed in their presentation. Dr. Baine makes explicit the difference between concrete concepts, which can be taught inductively, and defined or abstract concepts which depend on some external definition. He chooses to concentrate exclusively on the former. As a small point here, the use of behavioral jargon such as E and NE for examples and non-examples respectively, does not make the material easily accessible to the reader.

The final section covers formative and summative evaluation, with the emphasis on the former. In effect, this part loops the reader back to the beginning, since the development of goals and objectives is dependent, in part, on the procedures by which these will be evaluated, as the author points out. In fact, his checklist in this section is an excellent instrument for the evaluation of a unit of instructional material, whether designed by a local teacher, or produced by a commercial firm. Obviously, the critical issues in evaluation cannot be adequately dealt with in a scant 20 pages. Enough is presented, however, to give teachers or program designers some guidelines for looking at their work as they go along and when it is in use.

For all its depth in the areas covered, I would have liked to see more coverage of important additional topics. The issue of self-managed or self-monitored instructional programs was referred to in a paragraph. The continuous progress recording techniques developed by Ogden Lindsey and others, for instance, are unmentioned in this book. It is not fair, perhaps, to view a book in terms of what is not in it, but additional breadth would have strengthened it.

I was impressed enough that I have ordered it as a basic text for my graduate course in special education curriculum. Within the range of its stated purpose, this volume is excellent. No other single source is as clear, detailed and comprehensive, and supportive of student learning. The author has done a superb job of integration and organization and has created an almost tutorial text.

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THE SCHOOLS OF ONTARIO, 1876-1976. By Robert M. Stamp. Toronto: University of Toronto Press, 1982, 293 pp. (ISBN 0-8020-2437-8).

Beginning with Ontario's much-vaunted educational exhibit at the Philadelphia Exposition in 1876 to the centennial of the province's Ministry of Education in 1976, Robert M. Stamp, Co-ordinator of Canadian Studies Programs at the University of Calgary, provides a comprehensive review of the post-Ryersonian era of schooling in Ontario. To those who might ask why someone in the West was commissioned by the Ontario Historical Studies Board to undertake such a task, Stamp gives part of the answer in the preface. In questioning the "twin myths of centralization and superiority" found in much of Ontario's educational history, Stamp indicates that his analysis has been influenced by several perspectives. His parents, his wife, and Stamp himself were schooled in Ontario; only his children "were prevented from attending the schools of Ontario by the 1970s because of [his] decision to gain a spatial perspective on [his] native province by moving two thousand miles away." When his detachment and domestic bona fides are combined with another prefatory statement concerning his sympathy for periods of educational innovation, the reader is given a sense of what is to follow.

All of this suggests that Stamp would undoubtedly be comfortable with N. Sutherland's description of him as a "moderate revisionist." And while Stamp avoids the unswerving optimism of traditional historians of schooling in Ontario, such as C.E. Phillips or R.S. Harris, one doesn't have to go far into the work to find that he holds not a few Whiggish tendencies. For example, his chapter on "The Nooks and Crannies of Dr. Ryerson's Den," especially his comments on religion, language, and patriotism suggest that the principal difference between most traditional and moderate revisionist historians of Ontario education is methodological rather than ideological. To conclude, as Stamp does, that Catholic separate schools, whether anglophone or francophone, did not have the strengths or promise of the public school system, or that veneration for imperial institutions was a prelude to Canadian nationalism is to reflect the same onward and upward view of public schooling held by Phillips and others in the 1950s. Although Stamp's analysis manifests the sureness and competence of a social historian, he remains a public school promoter nonetheless. In 1977 J.D. Wilson in his landmark review, *Historiographical Perspectives on Canadian Educational History* wondered about the direction Stamp would take: "It will be interesting to observe to what extent Stamp is influenced by the radical school in his manuscript . . . on education in Ontario from 1876 to the present." While he is fully aware of the social control and related orientations of such radical revisionist historians as S. Prentice and T.R. Morrison, Stamp is neither negative in hindsight nor given to unmasking conspiracies.

Even if Stamp has been influenced by the radical critique, it is unlikely that it would have been helpful in his analysis of Catholic and francophone schools. Radicals are not given to attacking minority schools, the structure and outcomes of public schooling have been their principal targets. Traditional educational historians invariably viewed Catholic and francophone schools as reactionary holdouts and the Catholic hierarchy as villains for attempting to sustain them. Stamp's discussion of these institutions is fair, his research is reasonably thorough in terms of the themes discussed, but he offers nothing new or profound. One wonders, for example, about the economic and psychic costs experienced by generations of Catholic children because of separate school underfunding. Instead Stamp presents accounts of negotiations between the hierarchy and successive

government ministries, but even at the end of the work it is not clear whether separate schools have access to the same level of support as their public counterparts. One could well conclude that such a condition will only be achieved if Catholic schools follow the lead that francophone high schools took in 1968 when Premier John Robarts announced that these institutions would become part of the public rather than the separate school system. Robarts declared: "We do not intend to segregate the Franco-Ontarians from the mainstream of this province. Nor do they want to be segregated." As Catholic schools continue, it would seem, to be apart from mainstream Ontario, does one conclude that separate school supporters will continue to pay through a truncated and underfunded system for their obdurateness? Stamp's discussion seldom leaves the level of the titans involved; the pawns in the struggle receive scarcely a note.

One is also uneasy about Stamp's discussion of Ontario's new found tolerance of linguistic diversity. Federal bilingual initiatives and the reverberations of Quebec separatism deserve more attention, unless one assumes that the province's coming full circle from the restrictions of French language instruction of Regulation 17 in 1912 is yet another reflection of the innate superiority of Ontario's educational development. It will be recalled that this premise was one of the myths Stamp set out to question. An analysis of the realpolitik of this move together with the tentative steps towards multiculturalism might have led to a lively discussion of how the metropolis makes whatever accommodation is necessary in order to maintain hegemony. Stamp avoids the opportunity here as elsewhere to speculate on idiosyncratic reasons or on the shrewdness of political life that might have promoted such adjustments.

Stamp's discussion of the effects that industrialization had upon schooling is particularly valuable. Movements toward practical and vocational education in the late nineteenth and early twentieth century are well documented. But these discussions together with later efforts in technical and scientific education, prompted in part by advocates of human capital theory, sustain rather than dispel the myth of centralization. What is apparent is nearly all these initiatives were dependent on funding from the Ministry of Education. As the OECD's *Review of National Policies for Education (Canada, 1976)* indicates, "the reality of the educational governance developments of the past 10-15 years show a decisive move away from local school autonomy at least in matters of finance," and there is little in Stamp's analysis to contradict this assessment.

The discussion on the British connection favoured in the schools for much of the period is particularly telling. Anglo-Saxon racial superiority was a prevailing theme, and Stamp chronicles its hold on the minds of successive ministers of education. Modifications in this point of view began to appear in the late 1930s "with the internationalism of the League of Nations and the continental pull of the United States." But the old ties continued to be powerful, as the Conservatives found in 1943 when their references to the Empire helped them win a provincial election. These sentiments, however, began to wane after World War II, as did perennial attempts to find a form of religious instruction for public schools.

The old order seems to have been on its way out by the late 1960s. The publication of *Living and Learning* which Stamp describes as "the most radical and bold document to originate from the bureaucratic labyrinth of the provincial department of education" implied that Ontario might finally abandon Ryersonianism and move in new directions. Stamp is at his best here having carefully traced the steps leading to the "Liberalization of the Big Blue Schoolhouse" in earlier chapters on the New Education Movement at the start of the century and the progressive reforms of the late 1930s. But, of course, *Living*

and Learning with its emphasis on child-centredness had its critics, and its far-reaching recommendations evoked fears that their implementation would lead to chaos or that they were nothing more than a clever establishment ruse. So they became grist for the mills of radicals and traditionalists alike. Stamp lashes out at no one for slowing down or turning back many of the most promising reforms that surfaced during periods of educational innovation. His examination of the reasons for such recalcitrance is plausible. The open life style of the free schoolers, for example, was “too radical and inappropriate a model for Ontario or North American society to adopt en masse.” Local control movements didn’t take root in Ontario because students and parents were “more reluctant to seize power than were administrators to share it.” Changes in educational policy continued to reflect Ryerson’s successful formula: “proceed only as quickly as the conservative nature of provincial society will permit.” Although he does not say so explicitly, Stamp’s intimations are sufficient to lead the reader to conclude that Ontario has not changed its political or cultural boundaries over the last hundred years. In like manner he dispels the myth of Ontario’s educational superiority by demonstrating that the Province has not changed its schooling strategies or redistributed power in any significant way since Ryerson’s time. Whether he wishes the reader to arrive at such conclusions, however, is not clear, especially when the reader is left with a final statement about the “dynamic interaction” between “conservative and progressive paradigms” shaping the “values of Ontario’s educational experience.”

The book includes an interesting collection of pictures and an excellent set of notes, but is lacking in quantitative data concerning the origins and destination of pupils. At least one general map of Ontario and another of the more populated, southern region would have been helpful. A summary of the social, religious and educational backgrounds of the Premiers, Ministers of Education (who were often one and the same) and senior educational bureaucrats would have undoubtedly prompted some trenchant observations if not a fuller attempt in psychobiography. One must be thankful, nonetheless, for what Stamp has done. In an area of scholarship much given to publications of loosely connected series of articles introduced by an editorial overview, Stamp has written a good general history of schooling, and all those interested in the social history of Ontario should be well served by it.

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SPECIAL ISSUE-AUGUST 1983

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The University of Alberta

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Achievement, Behavioral Correlates
and Teachers' Perceptions of Francophone
and Anglophone Immersion Students

Comparisons between French and English achievement are drawn between francophone, anglophone and mixed subpopulations of students in French programs. Behavioral, cognitive, and academic correlates of language competence of the three subgroups are discussed. Correlations between English and French cloze performance and other intelligence and cognitive abilities were found to be high. Students who performed well on French cloze tests tended to perform well on English cloze tests as well. Differences between the mixed group and both the French and English groups are reported in terms of academic cooperation as well as teachers' perceptions of these subgroups.

Fifteen years ago bilingual education programs were almost nonexistent in Canada. Today, programs which use both French and English as media of instruction are in operation in every Canadian province and major city. Nevertheless there have been few reports of comparisons between different

Stephen T. Carey (PhD, University of Toronto) teaches at the Faculté Saint Jean of the University of Alberta. His research on memory and cognition is published in several journals; in 1974 and 1978 he edited two publications following from national conferences on bilingualism which were hosted at Faculté Saint Jean.

James Cummins (PhD, University of Alberta) teaches at the Modern Language Centre of the Ontario Institute for Studies in Education. His research interests centre on cognitive aspects of bilingualism and language acquisition; he is currently exploring the relationship between special education and bilingualism.

populations across Canada. Furthermore, while recent attention has focused on anglophone children acquiring French in immersion classes, it is important to realize that in all provinces outside of Quebec, francophone children are also receiving instruction in French immersion. Although the aim of bilingual programs for both anglophone and francophone students is the same, i.e. to develop functional bilingual skills including literacy in both languages, the educational experience of these two subgroups can differ widely. For anglophone children outside of Quebec, French as a new schooling experience or second language (French L2) is promoted in the immersion experience. However, for francophone children outside Quebec, it is the mother tongue and/or *home language* (French L1) that must be strongly promoted by the school *and* the home in order to maintain and improve students' French skills. That is, because the influence of English is so strong and assimilation so rapid in North American contexts outside of Quebec, French, rather than English, is the language which needs to be promoted most strongly by the school for both anglophone *and* francophone children if they are to develop a high level of bilingualism. Nevertheless, streaming of classes between anglophone and francophone subgroups is often promoted for a variety of reasons including different learning histories in French acquisition and different levels of initial mastery of the French language. It may be argued that both reasons necessitate different French programs which are specifically designed for the strengths and weaknesses of the two subgroups.

A related issue is whether or not francophone children will advance more rapidly in exclusively francophone schools. The complexity of this latter question is compounded by the fact that one of the principal concerns for both francophone and anglophone parental groups is the children's *English* achievement. For many of the francophone parents who have recently arrived from Quebec or abroad, English is often recognized as the language of social mobility and a failure to acquire a high level of English skills, it is thought, may considerably reduce the child's scope of economic and educational success. Similarly, many anglophone parents presume that the school plays an important role in developing the child's English skills and the relative lack of emphasis on the use of English in immersion schools is often a source of concern to parents. These interdependent issues are relevant to the immersion program in primary schools operated by the Edmonton Catholic School System (ECSS) where instruction is in the medium of French for 80% of the school day throughout the elementary schools which are attended by children from both francophone and anglophone homes.

The present study sought to gather information on these related issues by posing several questions. First, how do francophone, anglophone and mixed francophone-anglophone subpopulations compare in their relative mastery of French comprehension during the latter part of elementary school? Second, how do these francophone students compare with francophone students in Quebec or francophone students in exclusively francophone schools in Ontario? Third, how do francophone, anglophone and mixed francophone-anglophone students in Edmonton compare in terms of their English comprehension and how do these groups compare with anglophone students enrolled in regular programs? Fourth, what are the indicator or predictor variables that are associated with superior performance in French immersion that might be utilized to predict whether a given student would or would not experience difficulties in an immersion program? To answer the last question, this study also was aimed at examining the correlation between school behavioral factors, mental abilities, and French and

English performance in order to determine if there were potentially useful predictor variables for predicting French and English comprehension for both francophone and anglophone subpopulations. Finally, a study was conducted of how teachers perceived the subpopulations of francophone, anglophone, and mixed francophone-anglophone students to determine if the teachers' perceptions corresponded with the predictor variables of performance levels. This part of the study was effected in order to gain information on how the three different subgroups were perceived by the teachers and also how the subgroups perceived themselves in order to study the correlations between teacher perception of the student, students' self-perception, and performance in French immersion programs.

Method

Subjects

All grade 5 students in three schools (Grandin, St. Thomas, and Our Lady of Lourdes) of the Edmonton Catholic School System (ECSS) were tested. An eight-item questionnaire was administered to the children regarding their preference and frequency of usage of languages with each of their parents, siblings, teachers and friends within the school, the home, and the community. Children were assigned to one of four groups on the basis of their responses to this questionnaire.

Group 1: *Francophone* — children who spoke French most of the time at home;

Group 2: *Mixed* — children who spoke both French and English at home or who reported that they spoke English and that their parents spoke French most of the time;

Group 3: *Anglophone* — children who spoke English most of the time at home and whose parents spoke English most of the time;

Group 4: *Other* — children who spoke a language other than French or English to one or both parents.

There were 26 children in the Francophone group, 30 in the Mixed group, 41 in the Anglophone group, and 7 in the Other group.

Instruments

French and English Cloze Tests. In a cloze test, every *n*th word (in this particular case every 7th word) is deleted from a passage of prose and the students are asked to supply the missing words. Cloze tests have been previously used to evaluate the French and English performance of children in French immersion programs by Swain, Lapkin and Barik (1976) and by Lapkin and Swain (1977) in Eastern Canada; these tests have been found to provide both an efficient and comprehensive measure of language comprehension and production.

In order to allow comparisons to be made between the cloze performance of students in the immersion program in Edmonton and comparable children in Eastern Canada, we used cloze tests which had been developed by the Bilingual Education Project at the Ontario Institute for Studies in Education (Lapkin & Swain, 1977) because reliable data existed on cloze performance by comparable immersion students in Eastern Canada on these tests. These cloze tests for both English and French comprehension were of the following format:

The soup was very _____ and I cried because it burned
_____ tongue.

The instructions and procedure were the same as in the Lapkin and Swain study. The "exact" rather than "acceptable" criterion for correct answers was adopted for reasons outlined by Swain, Lapkin and Barik (1976) and Lapkin and Swain (1977).

Teacher's Rating Scale of Student Behavior. The teacher's rating scales of student behavior were adopted from Genesee and Hamayan (1980) where they had been used to examine behavioral correlates of French achievement in immersion programs. This nine-item questionnaire included questions on students' usage of French in classrooms and hallways, the initiation of (and response to) questions and discussion, classroom participation, sociability, work habits, homework completion, and requests for additional work. The results from these rating scales were submitted to factor analysis.

Students' Attitudes and Usage of French. On the student questionnaire, students were asked which language(s) they used with parents and siblings (items 1-6). The remaining three items asked to what extent students were eager or happy to have the opportunity of using French outside the classroom and which language they preferred to use with their teacher and friends.

Ability and Achievement Measures. The Lorge-Thorndike Verbal, Non-Verbal and Full Scale IQ scores and the reading and vocabulary subtest scores from the Canadian Tests of Basic Skills were taken for the ESSS immersion students from their school records.

Results

French and English Cloze Test Performance

The mean French and English cloze test scores for the four groups in the ESSS bilingual schools and the four comparable groups from Eastern Canada from the Lapkin and Swain study are presented in Table 1. A typographical error on item 14 of the French test meant that this item could not be used in the analysis. Thus, the scores on both the French and English test are from a total of 30. With the aid of data presented by Lapkin and Swain, it was possible to eliminate item 14 and prorate the French means for the Eastern Canadian groups.

Two-tailed t-tests with Welch adjustment for unequal variance showed no significant ($p \leq .05$) differences between the ESSS groups on the English cloze test. However differences between the Francophone and Anglophone ESSS groups on the French cloze test were significant ($p \leq .03$). Although the scores of the ESSS Other group are lower than those of the remaining three groups, the differences are not significant (due to the very small number) and are assumedly accountable for by the lower mean IQ of this group.

The ESSS francophone group performed as well as the Franco-Ontarian group (who attended separate Francophone Schools) on the French cloze test but less well than the Quebec francophone group. These data are consistent with the hypothesis that francophone students who are schooled with anglophone students in an immersion experience appear to perform as well in French using these tests as a measure as do francophones who attend exclusively francophone programs in Ontario. On the other hand the performance of francophone students in Quebec is clearly superior to that of both other francophone groups, presumably due to the

quality and quantity of French usage outside the school. Such findings underline the necessity of considering the quality of French that students use within and beyond the school in order to compare exclusively francophone and combined francophone and anglophone immersion programs. Similarly, any research results that would deal with the thorny question of exclusively francophone or anglophone schools would require that the results be constrained to that particular milieu or setting.

TABLE 1
ENGLISH AND FRENCH CLOZE TEST PERFORMANCE
OF GROUPS IN WESTERN AND EASTERN CANADA

	Mean French Cloze Score	Mean English Cloze Score	Mean Lorge-Thorndike Full-Scale "
ESSS Francophone (N=26)	16.3	19.5	(110)
ESSS Mixed (N=30)	14.4	20.7	(107)
ESSS Anglophone (N=41)	13.1	21.0	(112)
ESSS Other (N=7)	12.5	17.3	(99)
Immersion (LS)*** (N=94*)	15.3	21.2	(113)**
Regular (LS) (N=53)	--	20.7	
Franco-Ontarian (LS) (N=53)	15.7	--	
Quebec Francophone (LS) (N=26)	18.9	--	

* The N for the English test was 91.
** Based on the sum of Canadian Cognitive Abilities Test scores
(personal communication Sharon Lapkin).
*** LS from the Lapkin and Swain study.

The ESSS anglophone immersion group performed less well on the French cloze test than the Eastern anglophone immersion group, even though the groups are essentially identical in terms of IQ and English cloze test performance. This finding raises the unlikely question that anglophones may progress more rapidly in an exclusively anglophone immersion class than in a mixed francophone-anglophone immersion class. One of the many possible contributors to this difference is the fact that the eastern immersion group may have identified with the goals of the program more closely since the teacher could concentrate more on their particular needs.

In terms of English cloze test performance, there were no differences among the groups. These data indicate that the francophone, mixed and other groups perform as well on the English test as both the anglophone groups of students in three Edmonton schools and also as well as the regular anglophone classes and the

immersion students in Ontario on this test of English comprehension. These data are consistent with the idea that students can enroll in French immersion programs and their performance will be comparable in *English* comprehension with that of students enrolled in regular programs. As previously mentioned, however, such results, while informative in terms of comparing groups of students in diverse areas in Canada, do not imply control of the numerous variables which may be causally related to the outcome.

TABLE 2
CORRELATIONS BETWEEN ENGLISH AND FRENCH CLOZE TESTS
AND OTHER VARIABLES FOR TOTAL GROUP (N=104)

Variable	French Cloze	English Cloze
1. French Cloze	1.00	.57*
2. English Cloze	.57*	1.00
3. Lorge-Thorndike Full	.65*	.58*
4. Lorge-Thorndike Non-Verbal	.45*	.41*
5. Lorge-Thorndike Verbal	.68*	.60*
6. CTBS Reading	.61*	.66*
7. CTBS Vocabulary	.55*	.76*
8. Teacher Rating (TR)		
TR 1 Asks questions	.20*	.19
9. TR 2 Responds to questions	.27*	.18
10. TR 3 Group participation	.27*	.04
11. TR 4 Friends	.10	.15
12. TR 5 Lively	.03	.04
13. TR 6 French at recess	.13	-.21*
14. TR 7 Asks teacher's help	.10	.17
15. TR 8 French in corridors	.08	-.19
16. TR 9 Extra French at home	.47*	.17
17. Student Questionnaire (SQ)		
SQ 1 Language spoken by mother	.19	-.12
18. SQ 2 Language spoken by father	.19	-.06
19. SQ 3 Language spoken to mother	.18	-.12
20. SQ 4 Language spoken to father	.09	-.11
21. SQ 5 Language spoken to siblings	.19	-.06
22. SQ 6 Happy to speak French	.19	.11
23. SQ 7 Language preference to teacher	.17	.11
24. SQ 8 Language preference to friends	.09	-.09
25. Sex (1 = female, 2 = male)	-.26	-.09

* $p \leq .05$ (Due to missing data some coefficients are computed on less than 104 cases)

Correlates of French and English Cloze Performances

The correlations between English and French cloze performance and the other intelligence and cognitive abilities tests as well as behavioral variables are presented in Table 2. As in the Lapkin and Swain study, the correlations between the French and English cloze tests and the other cognitive/achievement variables are highly significant. Thus, students who perform well on French cloze tests also perform well on English cloze tests, on all 3 tests of IQ, and on tests of cognitive abilities and reading abilities. Therefore, the student who performs well on these French tests is, typically, highly competent in English as well and tends to be above average on the measures of intelligence and cognitive abilities including reading. Performance on the French cloze test is also strongly correlated with teachers' perceptions of children's willingness to perform extra work in French (TR 9) and to a lesser extent to teachers' perceptions of student class participation and initiation of and response to questions (TR 1-3). Thus, teachers perceive the students who score well on these French cloze tests to be very interested in extra work in French, active in class participation, question posing and question answering. Those students who do not perform well in English are perceived to be students who frequently use French at recess (TR 6). This relationship presumably indicates that it is mainly those children who feel less comfortable in English who use French at recess in these schools and that all other groups primarily use English at recess.

Group Differences on Behavioral and Attitudinal Indices

Differences between francophone, mixed, and anglophone groups on the Teacher Ratings and Student Attitudinal variables (SQ 6-8) are presented in Table 3. All significant ($p < .05$) differences (marked with *) are based on two-tailed T tests with Welch adjustment for unequal variance. The convention $F > M$ is used to indicate that children in the Francophone group were rated higher or more favourably than the Mixed group on the particular dimension.

The most striking differences are those between the French and Mixed groups. Teachers rate the French group as more cooperative academically (TR 1, 3, 7, 9; TR 2 approaches significance, $p < .06$), and more likely to use French at recess (TR 8). There are also large differences between these two groups in the extent to which they report usage of French with friends outside the school.

The French group are rated higher by their teachers (TR 6, 8) and rate themselves higher (SQ 8) than the English group in the extent to which they use French outside the classroom. The English group are rated higher than the Mixed group on two indices of academic cooperation (TR 7, 9).

The differences between the Mixed group and both French and English groups in terms of academic cooperation suggest that some individuals within the Mixed group may have ambivalent or negative feelings in relation to their usage of French and their attendance at French-medium schools. There are no differences between the groups in either IQ or English academic achievement (CTBS and cloze tests), thus the differences noted by the teachers seem likely to be specific to the children's attitude towards French. Although the Mixed group in the present study is not a homogenous group, approximately one-third of the children reported that both parents spoke French most of the time to them but that they spoke English most of the time to their parents. This pattern shows the strength of the assimilation process and suggests that the relative lack of academic

cooperation among some members of the Mixed group as perceived by their teachers may be related to conflict between francophone and anglophone roles and identities and, hence, the status of French as a language of communication.

TABLE 3
GROUP DIFFERENCES ON BEHAVIORAL
AND ATTITUDINAL INDICES

Variable	F>M	F>E	E>M
TR 1	*		
TR 2			
TR 3	**		
TR 4			
TR 5			
TR 6	*	**	
TR 7	*		*
TR 8		**	
TR 9	**		*
SQ 6			
SQ 7			
SQ 8	**	**	

* $p < .05$

** $p < .01$

Conclusions

On the French cloze tests the Edmonton francophone group performed better than the anglophone and mixed francophone-anglophone group and just as well as the comparable francophone group that was schooled in an exclusively francophone school in Ontario. These data do not corroborate the view that francophone students would necessarily advance more rapidly in an exclusively francophone school. However, the expected superior French cloze performance of francophones in Quebec does indicate the importance of the quality and quantity of French spoken both within and outside the school. On the other hand, the finding that ESSS anglophone students enrolled with francophone students performed less well than anglophone students enrolled with an anglophone only immersion program in Ontario in spite of the fact that their I.Q. and English cloze test performance was essentially identical, does lend credence to the value of separate programs for anglophone and francophone students. However, while such a possibility is intriguing, far more research would be required to legitimize such comparisons across schools. Any future research concerning the question of separate francophone and anglophone schools must address the question of the quality of the French that is spoken in the school, the family and the social

milieu. Moreover the high correlation between performance on the English cloze test and French cloze test indicates that those students who perform well in French also perform well in English and vice versa. While there may be some facilitating interaction of the two languages as consistent with the threshold hypothesis, these results are more plausibly interpreted as due to the strong cognitive component in language learning as indicated by the strong correlation with all IQ and cognitive ability tests.

However, it does not follow that only students with high cognitive abilities should enroll in immersion programs. On the contrary the controlled comparison between the Edmonton anglophone, francophone, and mixed immersion class and the regular Ontario anglophone class indicates that French was being acquired at no expense to their English skills as measured by these tests.

On the other hand, there was evidence that children from mixed home background are perceived less favorably by teachers in terms of their classroom participation and academic cooperation. In addition, these students showed a strong tendency to address their parents in English although their parents addressed them in French. Further research would be needed to elucidate the causal relation between the teachers' perception of the lack of academic cooperation of this group and their attitudes towards speaking French. In particular the teachers' perception of the mixed group to be less involved than the French group in: group participation (TR 3), asking questions (TR 1), asking for help (TR 7), and asking for extra French at home, than both the French and English subgroups may reflect the lowered status that speaking French has for these individuals as opposed to both the French *and* English subgroups. This is suggestive that the mixed group of students are perceived as less academically cooperative than both anglophone and francophone groups and either perceive themselves as belonging to neither of the principal student groups and/or identify less with the French language goals of the school.

Further research should involve an examination of how these subgroups perceive the status, importance, and utility of acquiring competence in French or how they perceive the learning environment. Presumably such information would have implications both for teachers' accurate perceptions of these different subgroups and consequently for their sensitivity and interaction with members of these different subgroups. Such data may well underline the importance of investigating attitudinal variables and their implication for the modification of teaching methodologies to promote appropriate attitudes in language learning situations. Such methodologies may include the infusion of culture components to enhance the status and communicative value and hence, students' attitude towards language acquisition.

References

- Genesee, F., & Hamayan, E. Individual differences in young second language learners. *Applied Psycholinguistics*, 1980, 1, 95-110.
- Lapkin, S., & Swain, M. The use of English and French cloze tests in a bilingual education program evaluation: Validity and error analysis. *Language Learning*, 1977, 27, 279-314.
- Swain, M., Lapkin, S., & Barik, H. C. The cloze test as a measure of second language proficiency for young children. *Working Papers on Bilingualism*, 1976, 11, 32-42.

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Determinants of Teacher Professionalism

In search of critical factors affecting teachers' attitudinal professionalism, variables at personal, school, and district/division levels were scrutinized and compared. One thousand two hundred and five teachers, about one-tenth of the teaching force in the province of Manitoba, Canada, from 120 elementary and secondary schools in metropolitan, small urban, and rural settings took part in the study. Analyses revealed the ascendance of district/division factors such as enrolment decline, teacher lay-off rate, perceived board-teacher relationship, feeling toward collective bargaining in shaping teachers' career attitudes, while personal factors faded into relative insignificance. On the other hand, the most single important factor affecting teachers' mentality still resided in their immediate working environment as peer relationship measured by group characteristics in school, affected profoundly from four out of five dimensions of professional attitudes. In view of the close association between peer norm and leadership style of the principals, it would seem to be of utmost importance for school administrators to develop appropriate intervention strategies to ensure an amiable and productive atmosphere to counterbalance adverse forces currently confronting public education.

For the past two decades, there has been an unmistakable upsurge of activism sponsored by teacher organizations aimed at gaining legal and social recognition of teaching as a profession. Militancy, identified as a natural outcome of the professionalization process (Corwin, 1965), manifests itself in demands for broadening the areas of negotiation, for greater participation in the decision-making process at all levels, and in strikes. On the other hand, strong resistance against such movement has come from vested interest groups both within and without the educational system. Understandably, the recognition of teaching as a profession would bring a fundamental change to the existing

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governance structure of education. Implicitly and explicitly, professionalization which demands the control of membership in the occupation, the licensing of teachers, the development and adherence to an ethical code, and the specification of working conditions would shift monitoring power from the provincial department or ministry of education and the local school board to the teacher organization. Given the magnitude of such a change and inherent opposition, it is doubtful that teachers will acquire full-fledged professional status in the near future.

Notwithstanding the formidable barriers, literature continues to debate the fundamental issue of whether or not teachers are truly professional. Two major problems, however, complicate this attempt at conceptual clarification. The first is the prevailing confusion between two aspects of professionalization, structural and attitudinal, as distinguished by Vollman and Mills (1966). While revamping the governance structure to achieve the structural aspect of professionalization is not going to materialize overnight, one should not hastily dismiss teachers as not truly professional. Indeed, it is the attitudinal dimension of professionalism, having profound effects on program delivery and the quality of instruction, that should constitute our major assessment criterion. The second problem is the way assessment of a vocation is achieved. By taking a snapshot of an occupation in the process of change and matching it against an ideal set of professional characteristics (e.g., Becker, 1963; Eisenstein, 1972; McDaniel, 1979), it is too tempting to reach a premature and inaccurate conclusion that either a vocation *is* or *is not* a profession. A more dynamic perspective encourages basing our judgment on the degree of professionalism a vocation displays, since all vocations can be placed on a continuum of professionalism during periods of rapid change.

Theoretical Framework

By refocusing professionalism on the attitudinal dimension, the seminal work of Richard Hall (1967), encompassing the following five aspects:

1. use of professional organization as a major referent;
2. belief in public service;
3. belief in self-regulation;
4. sense of calling to the Field; and
5. autonomy,

becomes the conceptual basis for the present assessment of teacher professionalism. Snizek's verification (1972) of 25 of the original 50 items that provide the best empirical fit constitutes a major component of such measures. In view of the present turbulent environment of the educational system, it is conceivable from a contingency perspective that the attitudinal dimension of professionalism registers both the degree of stress on the job and level of endurance teachers display. Thus a comprehensive study of teacher professionalism necessitates an inclusion and analysis of factors extracted from personal, school, and division levels.

At the personal level, attributes often cited as critical factors of attitudinal differences were sex (Hearn, 1971; Prather, 1971; Selinger & Goldhammer, 1972; Nastrom & Butler, 1975), teaching experiences (e.g., Lauglo, 1975; Lam, 1975), level of formal education (e.g., Bullough, 1970; Pavalko, 1970; Cortis, 1973), and professional development (e.g., Lam, 1982). In brief, sex was found to explain relative tolerance to the school bureaucratic system and the degree of militancy

displayed. Teaching experiences accounted for the degree of pedagogical commitment as well as relative assertion of professional autonomy. Level of formal education upheld "professional images" and promoted task devotion. Professional development tended to foster professional attitudes.

At the school level, three factors have been commonly cited to be related to the professional attitude of teachers. First was the grade level for which a teacher was responsible. Sharp contrasts were drawn between elementary and secondary school teachers in terms of perceptions, attitudes and satisfaction (e.g., Talmange & Orstein, 1973; Cortis, 1973). While recent findings do not dispute the significant impact this factor has on different attitudinal aspects of professionalism (Lam, 1982), it remains to be seen how crucial it is compared with other factors.

The second single factor at the local school level was colleague relationship. Recognizing that interaction between colleagues can become a valuable source for maintaining high levels of professional teaching, Doyle (1975) lamented that physical separation of the classroom and autonomy in teaching rendered teaching a private affair. In studying colleague reaction and teacher performances, Doyle and Olszewski (1976) further showed that open settings increased the commonality of behavior among teachers. Seidman (1975) singled out teachers' behavior as a critical factor contributing to climate outcomes.

A third factor at the school level associated with teachers' professional attitude is principals' leadership style. In view of the crucial supportive and supervisory role principals play, their leadership style is usually linked with teachers' perception of the school bureaucratic structure. There is no lack of research (e.g., Husarik & Wynkoop, 1974; Marjoribanks, 1977; Fraser, 1979) which stresses a need for principals to provide greater autonomy and to support and facilitate leader professional growth.

Much has also been reported about the impact on teachers' professional attitudes of the combined effects of collegial relationships and principals' leadership behaviors which constitute the organizational climate of the school (see Halpin & Croft, 1966). Coughlan (1971) for instance, reported that teachers working in a closed system did not feel that they had the same opportunity for upward advancement as did teachers in an open system. Null (1971) confirmed that certain attitudinal and personality variables of teachers were related to their perception of the behavior of their principal and fellow teachers and that teachers in an open climate tended to have a good attitude toward children.

At the district level, external factors representing major changes conceivably exert a profound influence on the professional attitude of teachers, though the empirical evidence is still scanty. One can speculate that declining enrolment and teacher lay-off might reduce the perceived importance of teachers' service to a community, hamper efforts at self-regulation, cast doubt on the sense of calling, repress the need for autonomy against bureaucratic control and promote greater adherence to the professional organization as a defensive mechanism against other political pressure.

As a response to the declining enrolment and teacher lay-off, teachers are likely to resort to a tougher stand in board-teacher negotiations. Literature widely documents that frustration of teachers has been transformed into demands for greater control of the policy-formulation process (Hennessy, 1975, 1977) which leads directly to challenges of school boards' jurisdiction and their operational

flexibilities (Glime, 1971; Young, 1971; Fay, 1976; Mankin, 1977; Newby, 1977). A recent empirical investigation in Manitoba (Lam & Kong, 1981) further confirmed the adverse effects of the present style of negotiation upon teacher-board relationships.

Arising from this body of literature and conjecture, enrolment decline and teacher lay-off, both actual and perceived, together with perceived board-teacher relationship and satisfaction with collective bargaining were viewed as relevant variables in accounting for teachers' attitudinal professionalism.

In addition, taking into consideration the growing realization of the profound extra-organizational influence on organization members' behavior and attitude (Griffiths, 1979) and the emergent contingency perspective (Hanson, 1979) which place increasing weight of population density, socioeconomic status and amount of community involvement on an organization's life, the effect of size and nature of the school setting upon teacher job attitude is interesting to explore. In particular it is anticipated that life-styles of the teaching profession in rural and urban settings are somewhat different and these together with the presence or absence of social and economic amenities in the communities would significantly affect teacher career attitude (Lam, 1982).

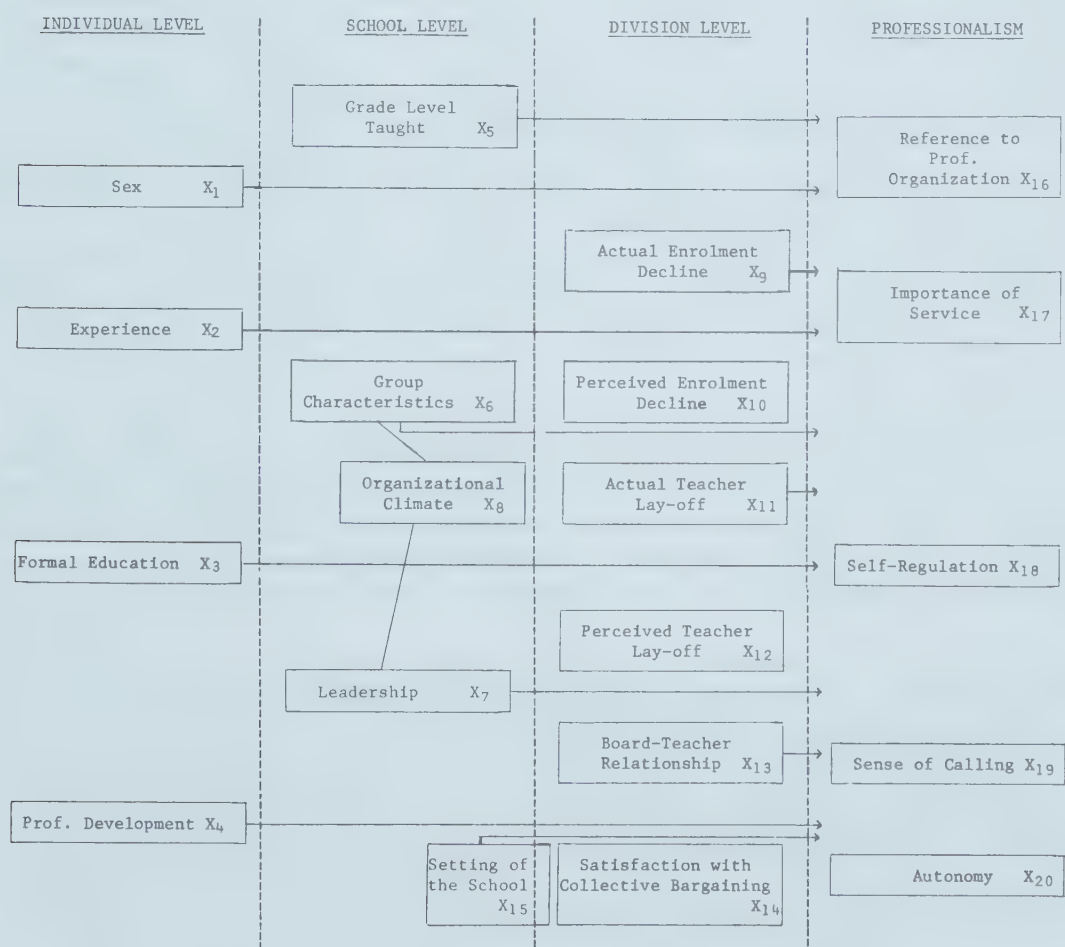


Figure 1. Schema for the teacher professionalism study.

In sum, constituting a paradigm addressed to the general question of what accounts for the attitudinal professionalism of teachers are three levels of factors considered to be of parallel importance. In the absence of literature on inter-relationships among these variables, no prediction of specific causal linkage was made (Fig. 1).

Understanding the degree of teacher attitudinal professionalism is of utmost importance to all concerned with the public education system when it is beset with growing problems. Where the professional attitudes deteriorate, it would be difficult to see how the quality of education demanded by the public could be ensured.

Methodology

Sample

To reflect provincial distribution of school districts and divisions in Manitoba, two school divisions from metropolitan areas, two from small urban and six from remote rural settings (representative of the ratio of number of divisions and districts in respective categories) were selected and approached for participation in the study. In total, 150 schools and 2300 teachers were included. About 1205 teachers from 120 schools in seven divisions and districts returned useful data for analysis. It is difficult to pinpoint causes for non-participation. One can only postulate sensitivity of the topic and substantial demands on teachers' time in providing data as plausible reasons. In view of the fact that participants represent one-tenth of the total teacher population in Manitoba, one can safely conclude that the present sample is big enough to warrant generalization of findings without jeopardizing external validity.

Testing of the paradigm developed in the earlier section necessitated that units of analysis be based on individuals, as the importance of personal factors could be assessed (on equal footing) with in-school and district factors.

Procedure and Design

Contact was made with each of the superintendents of the sampled districts and divisions. Upon approval of the school boards, all principals in each district were visited and briefed on the nature of the study. They were then asked to designate staff members to look after the distribution and collection of questionnaires anonymously. These were then sealed and returned to the researcher.

Each teacher was asked to respond to a questionnaire consisting of four parts. Part I dealt with personal and general background factors. Part II was used to examine the organizational climate of the school. The abbreviated format was adopted, ranking the eight subscales of Disengagement, Hindrance, Esprit, Intimacy, Aloofness, Production Emphasis, Thrust, and Consideration in terms of "High," "Average," "Low," as described by Hall (1972). Part III was designed to discover the issues in teachers' respective divisions, such as their perceived Board-Teacher relationships, satisfaction with collective bargaining, their relative concern with enrolment decline and teacher lay-off rates. Part IV contained Snizek's revised version of Hall's professionalism scale. Each of the 25 items in the revised version was accompanied by a five-point Likert scale ranging from the category of "Strongly Disagree" to that of "Strongly Agree."

Additional data concerning the enrolment and the number of teachers employed by the sampled division in the past five years were gathered from the Division (district) Offices. Index of average enrolment decline for each district was derived by summing the year to year difference in student population divided by the number of academic years involved. Teacher lay-off index was similarly developed by assessing the annual difference in number of teachers employed and average sum total of difference.

Analysis and Discussion

Prior to the assessment of the relative impacts of personal attributes, school and district factors upon various attitudinal dimensions of teacher professionalism, inter-relationships among all these factors had been analyzed (Table 1). Sex was found to be positively related to the actual teacher lay-off rate ($r=.93$). However, this latter factor was found to be related to the perceived teacher lay-off ($r=-.36$). Strong relationships also existed between group characteristics (X_6) and leadership style (X_7) displayed by the school administrators ($r=.48$). Further, both group characteristics and school organizational climates were closely linked with the perceived board-teacher relationships ($r_s=.61$ and $.52$ respectively). In another aspect, teacher experience (X_2) and professional development (X_4) were associated with grade level taught ($r_s=.31$ and $.30$) whereas setting was positively related to formal education and negatively related to perceived teacher lay-off rate ($r_s=.27$ and $-.26$).

What emerged, most interestingly, from this preliminary correlational analysis was that male teachers were related to the actual teacher lay-off. However, it was the female teachers who felt the "pinch" from the retrenchment, an error of perception confirmed by the negative correlation between the actual and perceived enrolment decline indices. A second interesting feature is that group characteristics and the overall school climate seemed to be associated with the perceived Board-teacher relationship, suggesting a growing intimate relationship between the internal and external working conditions for teachers.

Two other observations from the analyses should also be mentioned: one confirmed the common conviction that more teaching experience and greater benefits derived from professional development encouraged teachers to instruct higher grades; the other contradicted the belief that rural teachers were less well prepared compared with urban teachers when formal education and training were considered. All of these should substantiate the interpretation of subsequent analyses.

To the basic question as to what factors contributed most to each of the five aspects of professional attitudes, five stepwise regression analyses were performed (Table 2). In terms of the first dimension of attitudinal professionalism, namely "using of Professional Organization as a major referent," perceived teacher lay-off rate seemed to be the most important contributing factor, followed by grade level taught, board-teacher relationship and perceived usefulness of professional development.

With reference to the second dimension of attitudinal professionalism, "belief in public services," group characteristics of the teaching staff in school, and felt satisfaction with collective bargaining were found to be significant.

TABLE 1
ZERO-ORDER CORRELATION MATRIX OF VARIABLES
AND DIMENSIONS OF TEACHER PROFESSIONALISM

Variables	\bar{X}	S.D.	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}
<u>Individual Level</u>																	
Sex (X_1)	.42	.45															
Teaching Exp. (X_2)	15.71	17.99	.02														
Formal Ed. (X_3)	4.33	2.81	-.01	.02													
Prof. Dev. (X_4)	4.16	1.32	-.03	.16	.06												
<u>School Level</u>																	
Grade Level Taught (X_5)	4.85	5.21	-.02	.31**	.01	.30**											
Group Char. (X_6)	2.60	.50	.10	-.07	.04	.03	-.06										
Leadership (X_7)	2.19	.43	.05	.00	-.01	.03	.00	.48**									
Org. Climate (X_8)	2.54	.65	.07	.03	-.01	-.07	-.06	.40**	.58**								
<u>District/Division Level</u>																	
Actual Enrolment Decline (X_9)	.03	1.15	-.19	.00	.00	-.02	.25**	-.03	.02	-.06							
Perceived Enrolment Decline (X_{10})	2.94	1.14	.01	.05	.00	.03	.04	.02	.00	-.07	.00						
Actual Teacher Lay-off (X_{11})	4.04	3.32	.93**	.02	-.01	-.02	.00	.07	.05	.05	.00	.02					
Perceived Teacher Lay-off (X_{12})	3.42	1.22	-.36**	-.02	.02	.05	-.03	.04	-.05	.01	.04	.06	.23*				
Board-Teacher Relationship (X_{13})	4.23	1.85	.13	-.03	.03	-.03	-.02	.61**	.15	.52**	.01	.07	.11	.07			
Satisfaction with Coll. Bargaining (X_{14})	2.27	1.16	-.05	.09	.00	.13	.09	.13	.04	.03	.00	.63**	-.06	.25**	.00		
Settings (X_{15})	1.59	1.19	.08	.00	.27**	-.11	.01	.11	.04	.08	-.01	-.26**	.16	-.16	.09	.00	
<u>Dimension of Teacher Professionalism</u>																	
I. (X_{16})	2.94	.45	-.16	.00	.00	-.06	-.10	.06	-.04	-.06	.03	.00	-.10	.34**	-.06	.00	-.14
II. (X_{17})	3.08	.63	.05	-.03	.01	.00	-.04	.23*	.06	.07	-.02	.07	.10	-.02	.11	.13	.07
III. (X_{18})	3.34	.53	-.01	.00	-.04	.00	-.02	.20*	-.03	-.02	-.04	-.07	-.08	.00	-.04	-.03	.00
IV. (X_{19})	2.19	.64	-.01	.04	.00	-.06	-.06	-.11	-.03	.01	-.08	-.10	-.01	.02	-.11	-.10	-.02
V. (X_{20})	3.17	.66	-.01	-.05	.00	.01	-.08	.21*	.10	.07	.05	.12	-.01	.04	.14	.09	-.03

* $p < .05$ and $> .01$
** $p < .01$ or better

TABLE 2
STEPWISE REGRESSION ANALYSES OF SIGNIFICANT FACTORS
AFFECTING DIMENSIONS OF TEACHER PROFESSIONALISM

Significant Predictions	B	R	R ²	df ₁	df ₂	F
<u>I. Using of Prof. Org. as a Major Referent</u>						
Perceived Teacher Lay-off Rate (X ₁₅)	.32	.33	.11	1	1202	152.60**
Grade Level Taught (X ₅)	.17	.35	.12	2	1201	12.54**
Board-Teacher Relationship (X ₁₂)	-.17	-.36	.13	3	1200	7.14**
Usefulness of Prof. Development (X ₈)	-.16	-.37	.14	4	1199	4.83*
<u>II. Belief in Public Services</u>						
Group Characteristics (X ₉)	.22	.23	.05	1	1202	22.28**
Satisfaction w/Collective Bargaining (X)	.20	.27	.07	2	1201	15.60**
<u>III. Belief in Self-regulation</u>						
Group Characteristics (X ₉)	-.17	.20	.04	1	1202	7.47**
Perceived Enrolment Conditions (X ₁₂)	-.14	.27	.07	2	1201	4.27*
<u>IV. Sense of Calling to the Field</u>						
Group Characteristics (X ₉)	.18	.11	.01	1	1202	16.86**
Enrolment Decline Index (X ₂)	.17	.14	.02	2	1201	9.29**
Satisfaction w/ Collective Bargaining (X ₁₃)	.17	.17	.02	3	1200	9.31**
Perceived Enrolment Situation (X ₁₄)	.16	.18	.03	4	1199	5.53**
Teacher-Board Relationship (X ₁₂)	.18	.19	.03	5	1198	4.14*
Org. Climate (X ₁₁)	.18	.20	.04	6	1197	7.82**
<u>V. Autonomy</u>						
Group Characteristics (X ₉)	.18	.21	.04	1	1202	57.94**
Perceived Enrolment Situation (X ₁₄)	-.20	.23	.05	2	1201	11.42**
Grade Level Taught (X ₅)	.16	.24	.06	3	1200	7.05**
Enrolment Decline Index (X ₂)	.18	.25	.06	4	1199	8.02**
Satisfaction w/Collective Bargaining (X ₁₃)	.19	.26	.07	5	1198	.433*

* sig. at .05

** sig. at .01 or better

In examining the third aspect of attitudinal professionalism, "belief in self regulation," group characteristics and perceived enrolment conditions were important factors.

With respect to the "sense of calling to the field," the fourth dimension of attitudinal professionalism, it was found, in descending order of importance, that group characteristics of teaching staff, actual enrolment decline in the past five years, satisfaction with collective bargaining, perceived seriousness of enrolment decline, perceived teacher-board relationship and the overall school organization climate were key factors.

In scrutinizing the fifth and last aspect of attitudinal professionalism, "autonomy," group characteristics was once again the predominant contributing factor, followed by perceived enrolment decline, grade level taught, the actual enrolment decline and lastly, the satisfaction with collective bargaining.

One can postulate, from the findings, that in a time of declining enrolment, the need for job security serves as a significant motivating force in rallying teachers under their professional organization. Secondary school teachers apparently experiencing higher lay-off rates were more attached to the professional organization than their elementary counterparts. Similarly, those who perceived greater benefit in professional development also felt more inclined toward their own organization as many inservice activities were sponsored by local and provincial teacher associations.

The belief in the importance of teaching service to the community traces its causal sources to group characteristics of the teaching staff and satisfaction derived from collective bargaining. Apparently, peer relationships in schools affected teachers' perception of how amiable their working environment was, and experience from collective bargaining affected their perception of how their services had been valued by the public. The combined effects of these internal and external factors seemed then to determine teachers' own appraisal of the relative importance of their services.

The conviction of self-regulation or ongoing professional upgrading seemed to depend on group characteristics of their peers in school as well as the perceived enrolment decline. Presumably, where the teaching staff were not in harmonious relationship in school and the lay-off possibility was keenly felt, the desire for further study and professional growth would be severely hampered.

To the extent that group characteristics, organizational climate of the school, enrolment decline, perceived Board-teacher relationship, and satisfaction with collective bargaining, all affected "Sense of the calling to the field," it seemed evident that morale and career devotion were hinged to the intricate balance of favourable and adverse conditions both within and without the school.

In view of the strong causal relationship between group characteristics of the teaching staff and autonomy of teaching, one can suggest that mutual support was crucial to the freedom teachers felt they had in course delivery. Other autonomy-relevant in-school factors such as grade level taught reaffirmed earlier analysis that secondary teachers were more ready to exercise discretion than their elementary counterparts. Furthermore, because external factors such as enrolment decline, both actual and perceived, and the degree of satisfaction with collective bargaining all had considerable impact on autonomy, one can speculate that job security, real or imagined, and amiable experience in negotiation allows teachers a wider latitude in carrying out their teaching responsibilities.

Overall, data generated from the study point to the need for considerable refinement of the model initially conceived to account for the five aspects of teacher professionalism. While individual factors display interesting relationship patterns with factors at other levels, none has any important direct impact upon teacher professionalism. The relative insignificance of this group of factors seems to highlight a changing context of the teaching profession which accounts for the present findings being inconsistent with earlier studies. As well, one notes the emergence of external school factors assuming a more vital role in shaping teacher professionalism. Implicitly and explicitly the relative shift in importance reflects a growing uniformity in teachers' backgrounds both in terms of formal education and professional development. At the same time, teachers' career mentality is increasingly to be understood by what is going on in the more global situations. In view of growing politicization engulfing the educational enterprise, the preliminary findings from this study should stir further investigations in this crucial area.

The contribution of school factors to teacher professionalism is on the whole moderate. However, group characteristics of the teaching staff stands out as the single most important factor for shaping various aspects of professional attitudes, denoting a continued importance of the immediate working environment, i.e., peers' social norm, in shaping teachers' career mentality and outlooks.

To the extent that school administrators' leadership style has close association with such social norms, administrators are placed in a critical position in balancing the on-the-job professional growth of their teachers against adverse global situations in the public school system. The search for an appropriate leadership style to decrease teachers' tendency towards disengagement from school activities and felt hindrance to doing their job, to bolster teachers' professional commitment, and to increase social intimacy becomes a primary challenge to school administrators in the eighties.

References

- Becker, H. The teacher in the authority system of the public school. *Journal of Educational Sociology*, Nov. 1963, 136-144.
- Bullough, V. L. Education and professionalization: A historical example. *History of Education Quarterly*, 1970, 10(2), 160-169.
- Cortis, G. A. An analysis of some differences between primary and secondary teachers. *Educational Research*, 1973, 15(2), 109-144.
- Corwin, R. G. Militant professionalism, initiative and compliance in public education. *Sociology of Education*, 1965, 38, 310-331.
- Coughlan, R. J. Job satisfaction in relatively closed and open schools. *Educational Administration Quarterly*, 1971, 7(2), 40-59.
- Doyle, W., Environmental influences on personal behavior: A case of elementary teaching. *The Journal of Educational Research*, 1975, 70(2), 55-58.
- Doyle, W., & Olszewski, R. W. Colleague interaction and teacher performance. *Education*, 1976, 95(3), 276-279.
- Eisenstein, H. S. Professionalization and teaching: A critique. *Urban Education*, 1972, 7(1), 79-94.
- Fay, J. M. Changing the power balance. Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, California, April 19-23, 1976.
- Fraser, K. P. Supervisory behavior and teacher satisfaction. Unpublished doctoral dissertation, Montana State University, 1979.

- Glime, R. G. Bargaining with teachers: The things the board should demand. *American School Board Journal*, 1971, 153, June, 21-23.
- Griffiths, D. E. Intellectual turmoil in educational administration. *Educational Administration Quarterly*, 1979, 15(3), 43-65.
- Hall, R. H. Components of professionalization. Paper presented at the Annual Meeting of the American Sociological Association, San Francisco, California, 1967.
- Hall, J. W. A comparison of Halpin and Croft's organization climates and Likert, and Likert's organizational systems. *Administrative Science Quarterly*, 1972, 17(4), 586-598.
- Halpin, A. W., & Croft, D. B. *The organizational climate of schools*. Chicago: Midwest Administrative Centre, University of Chicago, 1963.
- Hanson, E. M. School management and contingency theory: An emerging perspective. *Educational Administration Quarterly*, 1979, 15(2), 98-116.
- Hearn, J. J. Teachers' sense of alienation with respect to school system structure. *Phi Delta Kappan*, 1971, 53(5), 312.
- Hennessy, P. H. Teacher militancy. Canadian Teachers Federation: Ontario, July 1975, 1-80.
- Hennessy, P. H. Collective bargaining and the professionalization of Ontario teachers. *Teacher Education*, 1977, 10, 20-31.
- Husarik, E. A. & Wynkoop, R. J. A principal's dilemma: Can supervision be collegial? *NASSP Bulletin*, 1974, 58(386), 12-19.
- Lam, Y. L. J., Educational technology in different socio-cultural settings. *Canadian and International Education*, 1975, 4(1), 55-67.
- Lam, Y. L. J. & Kong, S. L. Effects of collective bargaining on teacher-board relationships. *Challenge*, 1981, 21(1).
- Lam, Y. L. J. Teacher professionalism profile: A personal and contextual analysis. *Alberta Journal of Educational Research*, 1982, 28(2), 122-134.
- Lauglo, J. Teachers' social origins: Career commitment during university and occupational attitudes. *Sociology of Education*, 1975, 48(3), 287-307.
- Marjoribanks, K. Bureaucratic orientations, autonomy and the professional attitudes of teachers. *Journal of Educational Administration*, 1977, 15(1), 104-113.
- Mankin, L. D. Public employee organizations: The quest for legitimacy. *Public Personnel Management*, 1977, 6(5), 334-40.
- McDaniel, T. R. The de-professionalization of teachers. *Educational Forum*, 1979, 43(2), 229-237.
- Nastrom, R. R., & Butler, W. E. The professionalism of women teachers. *Kappa Delta Phi*, 1975, 12(1), 6-8.
- Newby, K. A. Collective bargaining — Practices and attitudes of school management. Research report for Institution, National School Boards Association, Washington, D. C., 1977, 46 pages.
- Null, E. J. Relationships between personal variables of teachers and their perception of the behavior of school personnel. *The Journal of Educational Research*, 1971, 64(8), 351-354.
- Pavalko, R. M. Recruitment to teaching: Patterns of selection and retention. *Sociology of Education*, 1970, 43(3), 340-353.
- Prather, J. Why can't women be more like men: A summary of the sociopsychological factors hindering women's advancement in the professions. *American Behavioral Scientist*, 1971, 15(2), 172-182.
- Seidman, R. M. Comparing physical openness and climate openness of elementary schools. *Education*, 1975, 95(4), 345-350.
- Selinger, A., & Goldhammer, K. The roots of teacher militancy. In P. J. Cistone (Ed.), *School boards and the political fact*. Toronto: O.I.S.E., 1972, 45-52.

- Snizek, W. E. Hall's professionalism scale: An empirical reassessment. *American Sociological Review*, 1972, 27, 109-114.
- Talmange, H., & Orstein, A. C. Teachers' perception of decision making roles and responsibilities in defining accountability. *Journal of Negro Education*, 1973, 13(2), 212-221.
- Vollman, H. M., & Mills, D. L. *Professionalization*. Englewood Cliffs, New Jersey: Prentice-Hall Inc., 1966.
- Young, L. G. Is collective bargaining compatible with educational objectives. *Alberta School Trustees*, 1971, 41, 3-6.

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A Comparison of Scaling and Correlational Analysis of Perceptions of Mathematics Objectives

Mathematics teachers from university, vocational colleges, and high schools were presented with a paired comparison task on the relative importance of a set of mathematics objectives. Responses were analysed using correlational and multidimensional scaling techniques. Despite substantial individual differences, there was more agreement within than across institutional types. There were substantial differences between university and vocational teachers, with secondary teachers in the middle. Unequivocal labelling of the scaling dimensions was not possible, but they showed clear separation of university from vocational teachers. Discussion focuses on the relationship between the two analyses and on the practicality of scaling analysis for future research, with some discussion of the curricular implications of the substantive results.

This study has two purposes, one methodological and the other substantive, the first being more central. The purposes are: first, to investigate the feasibility of multidimensional scaling as a tool for the analysis of perceptions of the relative importance of curricular objectives; and second, to examine the relative importance of a set of objectives of the high school mathematics program. The particular aspect of the school program chosen should be thought of as an example, although not without its own importance.

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One of the more persistent dilemmas of those attempting curriculum reform is the difficulty of changing, despite administrative mandate, the actual teaching processes in place at the classroom level (see, for example, Fullan and Pomfret, 1977). As reported in the literature, many attempts at “top-down” innovation fail. This is probably due to inertial forces which induce teachers to carry on with their teaching in the same manner as they always have, regardless of the hopes and admonitions of program developers, text writers, or supervisory personnel.

One perspective from which to view this situation is that of the teachers’ perceptions of what is important in the subject matter at hand. It can be hypothesized that, when teachers deviate from suggested or prescribed topics or teaching methods, they do so in a direction which corresponds to their own biases. Further, one might expect a substantial relationship between the degree of disagreement with “official” priorities and the amount of deviation from prescribed curricula. Multidimensional scaling, particularly in individualized form (Carroll & Chang, 1970), offers a tool by which perceptions of similarity, in this case similarity of importance, may be compared both across individuals and across groups.

This study was designed to investigate the extent of agreement on priorities among the objectives of a high school mathematics program as judged by three groups of mathematics teachers—high school, postsecondary district vocational schools, and first year university—and particularly to evaluate scaling procedures as a curriculum research technique. Recent national surveys have been conducted in the United States (Priorities in School Mathematics, 1981) and in Canada (Worth *et al.*, 1981) on the preferences of various concerned groups for alternative content topics and instructional goals. A wide range of priorities was found within the lay, school, and postsecondary education groups of respondents as well as between these various groups. The perceptions of teachers, besides differing from those of other groups, such as parents or teacher supervisors, also differed greatly even among themselves. In this study, we attempt to draw a link between the perceptions of priorities among teachers and the assumed needs and interests of the students they teach.

Data were collected by a preference questionnaire, and analyzed by correlational and multidimensional scaling techniques. The main focus of this report is to compare the two analytic approaches, with a view to demonstrating the possible information available, using the scaling techniques, from ratings of the importance of objectives.

Although no attempt was made in this study to link perceptions of priorities with teaching practice, the substantive results have the potential for influencing the direction of research, for example, differences between curriculum as planned and as implemented; teacher training, particularly attitude development; and curriculum development and implementation. By introducing a technique relatively unknown in curriculum research, it was hoped that other applications of interest in other substantive fields would be encouraged.

The reasons for teachers holding the views they do may be very complex. However, it is a reasonable supposition that these views are related to the needs of the students with whom they have the most contact, to the teachers’ perceptions of these needs, and to the teachers’ own backgrounds. Using mathematics as an example, teachers of technology students in a vocational school might be expected to view mathematics very much as an applied subject and hold beliefs about

mathematics which paint it as a servant of science and technology rather than as an end in itself. On the other hand, highly trained academic mathematicians, teaching at the university level, might be expected to bend more toward pure rather than applied mathematics.

Teachers at the high school level are accustomed to a wide variety of students, from future university mathematics majors to those barely able to cope with the most basic skills. Thus they might be expected to vary considerably in their perceptions of priorities. This particular study is set in the Newfoundland context, with provincially set external exams required for high school graduation. It might therefore be supposed that this constraint imposes a degree of unity on the perceptions of teachers not found in other jurisdictions.

While the above discussion contains an outline of broad expectations for findings of the study, there is no intention to suggest that place of employment is the sole or even the major determinant of curricular priorities. The three groups described may serve as useful categorizations, but substantial inter-individual differences, even within the groups, were expected. The working hypothesis in the study was that there would be, despite individual variations, more agreement on priorities within each institutional type than across institutional types.

Instrument

A set of nine major content areas were selected by the authors to cover the major topics of the academic level (postsecondary bound) mathematics curriculum for the final year of high school in Newfoundland. A panel of mathematics teachers agreed that, given a limited number of content areas, these nine were a good representation of the mathematics program. As will be seen below, the nature of the rating task required of respondents imposed a limit on the number of objectives chosen. Within each content area, two objectives were written. The objectives dealt with the following content areas:

- 1 and 2 — computational skills
- 3 and 4 — measurement
- 5 and 6 — geometry
- 7 and 8 — graphing and data analysis
- 9 and 10 — algebraic algorithms
- 11 and 12 — mathematical functions
- 13 and 14 — probability and statistics
- 15 and 16 — mathematical proof
- 17 and 18 — applications of mathematics

Within each pair, the first member was written at a low level of cognitive complexity, and the second at a higher level. The first member of each pair might be considered to be addressed to the lower levels of cognitive skill and the second to the higher levels.

The eighteen objectives are as follows:

1. To acquire the basic computational skills related to the real number system and its subsets, including associated algorithms.
2. To develop efficiency in computations through understanding of the operations and properties of the number systems.
3. To develop a facility for measurement of length, area, volume, etc.
4. To develop understanding of precision and estimation in measurement, and their effect in interpreting solutions to problems.

5. To state geometric properties dealing with such topics as similarity, congruence and right triangles.
6. To develop an understanding of the structure of geometry, including the generation of geometric relationship from basic assumptions.
7. To take a set of data, tabulate it, and present it in meaningful graphical form.
8. To analyze, interpret, and draw inferences from data presented in graphs and tables.
9. To develop algebraic skills such as the use of algorithms, simplification of expressions and the solving of equations and inequalities.
10. To justify the sequence of steps used in any algebraic algorithm.
11. To represent the relationship between sets of numbers by using graphs, tables and algebraic or trigonometric sentences.
12. To recognize the concept of function as being relevant and unifying for the various branches of mathematics.
13. To apply basic principles of probability and statistics such as mean, mode and standard deviation.
14. To interpret statistical data for the purpose of making inferences or drawing conclusions.
15. To follow the steps in a given proof by comprehending the sequence of the premises and conclusions involved.
16. To carry through a consistent argument to a valid conclusion.
17. To identify applications of mathematics to the physical sciences, industry, technology and consumerism.
18. To select appropriate mathematical procedures in order to help solve a specific real life problem.

In general, those we describe as being lower level call for the algorithmic demonstration of routine skills or knowledge, while the higher level objectives call for fuller understanding of the principles behind the more routine objectives. Although our panel reached agreement on the validity of our nine by two conceptualization of the mathematics curriculum, we recognize the possibility of other, quite different ways of viewing mathematics.

To form our questionnaire, all possible pairs (153) of the objectives were placed in random order, and a random half of the pairs reversed. The pairs of objectives were reproduced on 17 pages, 9 to a page. Each subject was presented with the pages in random order. A second copy of one of the pages was randomly chosen, and placed at the front of the questionnaire for practice and to serve as a check on consistency. The random order of pages was disturbed to ensure that the duplicate of this practice page was near the end of the questionnaire. The second response to this page was incorporated into the final results, while the first was used as a check on consistency.

Subjects were asked to indicate which member of each pair of objectives they considered more important for the high school matriculation curriculum. (This stream is the middle of three in the Newfoundland curriculum. It is acceptable for university entrance and many of the vocational school programs.) No other instructions were provided.

Sample

There were three groups of teachers asked to respond to the questionnaire: a random sample of 50 high school teachers of grade ten or eleven academic mathematics (Newfoundland high school ended at grade eleven at the time of this study, 1979); a second random sample of 50 mathematics teachers from the provincial district vocational school system; and all 30 teachers of first year mathematics at Memorial University, the only university in the province.

With follow-up, usable responses were obtained from 24, 31, and 18 teachers from each of these three groups respectively. The low response rate might bias the substantive conclusions of our report, but not the methodological points. We suspect, however, that any bias would be slight, and would tend merely to overrepresent the opinions of those who took the trouble to respond to our request. As well as these 73 respondents, a different sample of 13 high school teachers was asked to complete the questionnaire twice, three weeks apart, to allow for estimation of test-retest reliability.

Analysis

Data were first checked for completeness. One subject who inadvertently missed a page was dropped from the analysis. There were eight cases of skipped items (of 11 169 judgements). These items were randomly assigned to a choice.

Next, a set of preference scores was developed for each respondent. These consisted of a value for each objective from 0 to 17, corresponding to the number of other objectives over which each one was chosen. From these data, group average preference scores were calculated for each group of teachers, and for the entire group of 73.

From these individual preference score sets, a 73 person by 73 person correlation matrix was calculated, giving the correlation of each respondent's choices with all others. Using correlational methods, these data were used to address the purposes outlined in the introduction.

The first step in the scaling analysis was to rearrange each person's data into a dominance half-matrix, as shown in Figure 1(a). In these matrices, a '1' indicates that the row objective was chosen over the column, and a '0' the opposite. Next, using each individual's preference scores, an index of dissimilarity was calculated for each pair of objectives. The index consisted of the absolute difference between the preference scores for each pair of objectives. For example, from Figure 1(a), objectives 3, 4, and 7 were chosen over, respectively, eleven, three and twelve other objectives. The dissimilarity scores are: for the pair (4, 3), 8; for (7, 3) 1; and for (7, 4), 9. (See Figure 1(b) for these values.) Note that, with this technique, the preference information is lost. That is, if the preference scores for objectives 3 and 4 had been reversed (e.g., 3 and 11 rather than 11 and 3), the dissimilarity score for the pair would still be 8. One possible function of multidimensional scaling is the recovery of this directional preference information from non-directional dissimilarity information. While, in this case, the advantages of such a property of scaling methods may not be clear, recovery is clearly beneficial in situations where only dissimilarity information is available.

A scaling analysis was performed on the set of 73 dissimilarity half-matrices, using the INDSCAL procedure (Carroll & Chang, 1970), in the revised and more efficient SINDSCAL algorithm (Pruzansky, 1975). Since detailed discussion of the mathematical models underlying various scaling techniques is beyond the scope of

this article, the reader is referred to the original references or, for a slightly less mathematical treatment of the principles involved, to MacCallum (1974). A sketch of the methodology is incorporated below.

Individualized scaling, in a manner similar to a three-dimensional factor analysis, produces a set of loadings of objectives on dimensions, which might indicate, through interpretation, the grounds on which judgements differ, and a second set of loadings of individuals on the same dimensions, indicating how important, or salient, that particular dimension was in the individual's judgements. For example, Carroll and Wish (1974) presented subjects with a task requiring ratings of the similarity of nations. Results showed that subjects discriminated among nations on two dimensions, labelled by the authors as "developed-underdeveloped" and "communist-western." Respondents were independently categorized as "hawks" or "doves." It was found that the hawks gave more salience to the communist-western dimension, and the doves more to the developed-underdeveloped dimension. Thus, for example, hawks rated China and India relatively far apart, while doves rated them relatively similar.

Although analysis in the current study was done in four, three, two and one dimensions, goodness-of-fit measures for SINDSCAL, as well as considerations of interpretability suggested that the two-dimensional solutions were most meaningful. Only two-dimensional solutions are reported here.

By comparing saliences of the dimensions for individual members of each of the three groups of teachers, we can come to some understanding of group differences in perceptions. However, such analysis is limited because SINDSCAL results are non-arbitrary and thus cannot be rotated in the manner of, for example, Varimax rotation of factor analytic results (Carroll & Chang, 1970). In order to provide a more precise comparison between groups, a second type of scaling analysis must be introduced. The second analysis was performed using the MDSCAL program (Kruskal, 1964a, 1964b) in version 5M (Kruskal & Carmone, 1971). Individual dissimilarity matrices [as in Figure 1(b)] were averaged, producing a group average matrix for each of the three groups of teachers. In MDSCAL, as with the SINDSCAL procedure, objectives are put into a many-dimensional space depicting, in a manner analogous to factor analysis, the dissimilarities among objectives. Inspection of the meanings of the points, in this case, objectives, provides labels for the dimensions and, by inference, reasons for differences in perception among subjects. While a standard rotational procedure such as Varimax might be appropriate for the MDSCAL results, in this study a rotation to a target matrix under conditions of arbitrary translation of origin and dilation of dimensions (Schonemann & Carroll, 1970; Lingoes and Schonemann, 1974) was used. Each group solution was rotated to the group average space of the SINDSCAL solution. This rotation produces a measure of fit, a matrix equivalent of a coefficient of alienation, which can be related to a Pearson correlation coefficient. As well as rotations to the SINDSCAL results, the group MDSCAL results were rotated to each group in order to assess the degree of correspondence between groups. Thus, use of MDSCAL gives quantitative comparisons between group scaling results.

Finally, in an attempt to shed light on the differences in perception, the results of individuals who differed markedly in their dimension loadings in the SINDSCAL analysis were examined.

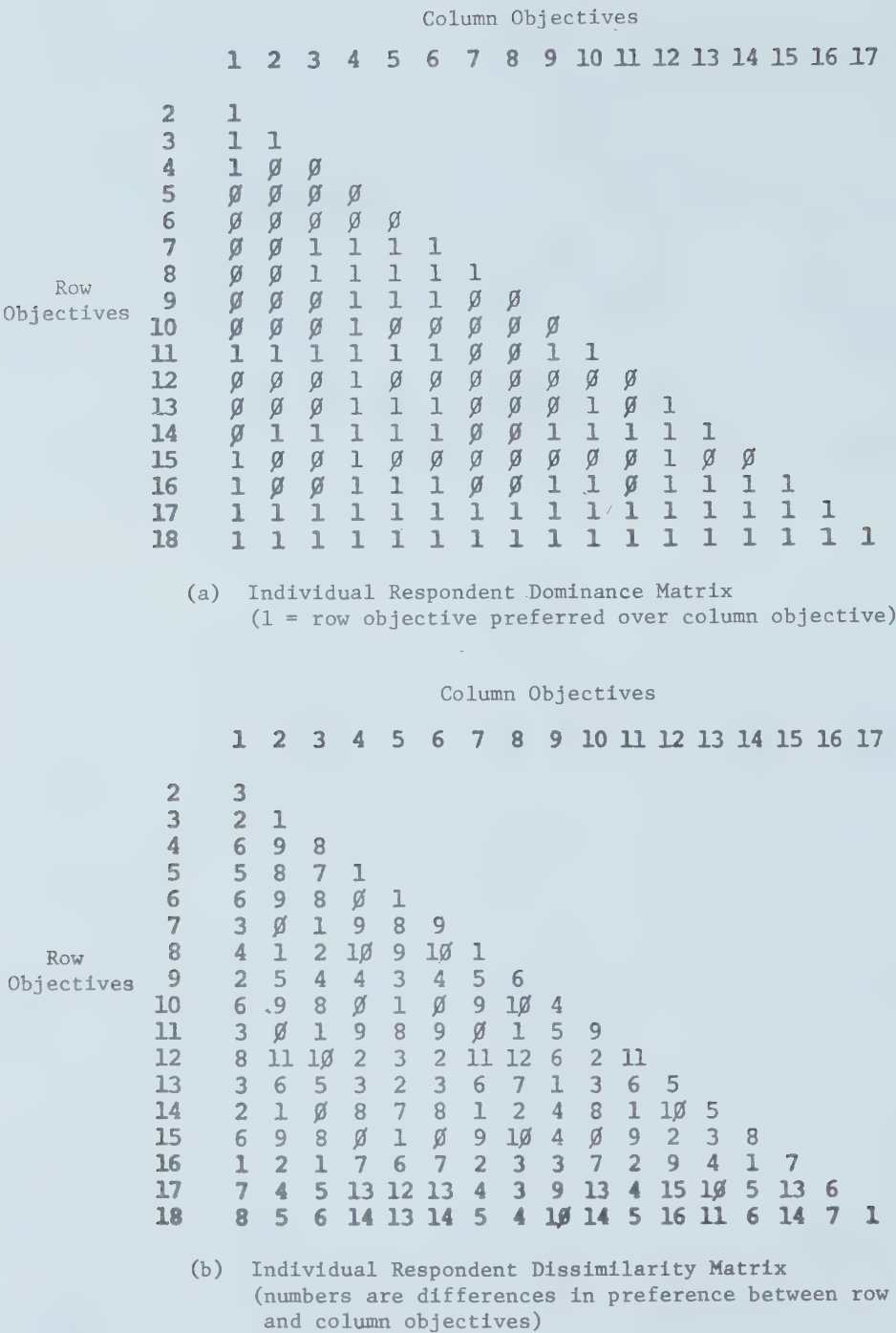


Figure 1.

In summary, then, results of the within and between group differences based on the correlational analysis were compared with the scaling results. In theory, goodness-of-fit among group scaling solutions should be related to high between-group correlations. The loadings of individuals in the SINDSCAL solution should be related to the pattern of the subject by subject intercorrelation matrix. Formal statements of research hypotheses have not been provided as they would not improve clarity.

Results and Discussion

Reliability

The test-retest stability correlations performed on the preference scores ranged from 0.68 to 1.00, with an average, using Fisher's z , of 0.90. This indicates substantial stability of the judgements over time. In the repeated-page individual consistency measures, on a total of nine possible agreements, only 10 of the 73 subjects had fewer than six agreements. The other 63 had between six and nine. The average was 7.3 agreements of a possible 9, or 81%.

TABLE 1
RANK ORDER OF PREFERENCES

Objective	High School (=24)	Vocational School (=31)	University (=18)	Total Group (=73)
1. Computation-L	4	5	3.5	4
2. Computation-H	3	2	3.5	2
3. Measurement-L	11	6	17	13
4. Measurement-H	15	4	13	9
5. Geometry-L	14	15	12	16
6. Geometry-H	8	14	5	10
7. Graphing-L	12	10	15	12
8. Graphing-H	7	8	11	7
9. Algorithms-L	2	9	1	3
10. Algorithms-H	17	18	10	17
11. Functions-L	6	13	7	8
12. Functions-H	16	16	8	15
13. Probability-L	18	17	18	18
14. Probability-H	13	11	16	14
15. Proof-L	10	12	9	11
16. Proof-H	5	7	2	5
17. Applications-L	9	3	14	6
18. Applications-H	1	1	6	1
SUM--Low level objectives	86	90	96.5	91
SUM--High level objectives	85	81	74.5	80

$r_{HS-DVS} = 0.65;$ $r_{HS-U} = 0.73;$ $r_{DVS-U} = 0.21$

HS - high school
DVS - district vocational school
U - university

Preference rank orders

In Table 1, the rank order of the preferences of each group of teachers, as well as the entire sample are presented. The two bottom rows show summed ranks for high and low level objectives. Overall, there was a slight trend to favour the higher level statements of the objectives, varying from no effect for the high school teachers to a substantial effect for the university teachers. Between-group correlation matrices are footnoted to the table. The relationships between rankings across groups were modest in two cases and quite small between the vocational school and university teachers. Looking at individual topics, the most noticeable differences were the relative importance of measurement and applications to the vocational school teachers, and the lack of importance of functions and geometry

to them. Overall, measurement, geometry, and probability were the least important, applications and computations the most important. Except for algorithms and functions, the trend was for the higher level objective of each pair to be rated as more important.

Correlational analysis

The results of the correlational analysis of the preference scores are reported in Table 2. After converting to Fisher's z , the average correlation within each group and across each pair of groups was calculated. These are reported in Table 2(a). The results of the analyses of variance on the sets of Fisher's z -scores among all members of the groups indicated are reported in Table 2, (b) to (e). In the latter three cases, the two within group sets of scores were pooled for comparison with the scores between the same two groups. It was observed that, most importantly, average correlation was quite small between individuals, indicating that individual variation rather than place of employment is still the most important factor in perceived priorities. Also, as indicated by the results of Table 2(b), group membership did play some role in the perceptions. There was most agreement among university teachers and least among high school teachers. From the rest of the table [(c) to (e)] it was concluded that, for two of the three comparisons, there was significantly more agreement among members of particular groups than there was between those two groups.

TABLE 2
SUMMARY OF CORRELATIONAL ANALYSIS^a

(a) <u>Average Correlation</u>					
	<u>HS</u>	<u>DVS</u>	<u>U</u>		
HS	0.22				
DVS	0.20	0.27			
U	0.23	0.08	0.35		
<hr/>					
Source	SS	df	MS	<i>F</i>	<i>p</i>
<hr/>					
(b) <u>Anova, within three groups</u>					
Between	1.903	2	0.952	7.08	.001
Within	119.807	891	0.1345		
(c) <u>Anova, within vs. across, HS and DVS</u>					
Between	0.853	1	0.853	6.76	.01
Within	187.26	1483	0.1263		
(d) <u>Anova, within vs. across, HS vs. U</u>					
Between	0.259	1	0.259	1.91	.17
Within	116.30	859	0.1354		
(e) <u>Anova, within vs. across, DVS vs. U</u>					
Between	12.575	1	12.575	94.9	0.00
Within	155.529	1174	0.1325		

^a HS - high school
DVS - district vocational school
U - university

Scaling results

In Table 3, the stimulus weights (objective weights) for the two-dimensional SINDSCAL solution are reported. Even though at first glance it seems that information similar to the ranking analysis of Table 1 has been recovered by the scaling, interpretation is not clear. The dimensions of the scaling solution are correlated 0.69 and -0.67 with the preference rankings of the right hand column of Table 1, and -0.07 with each other. (The negative signs are an artifact of the scaling analysis, and can be ignored.) Neither dimension can be simply labelled, "preference." Also, it seems clear that neither dimension can be labelled on the basis of the lower and higher cognitive levels required of the objectives. In almost all cases, objectives from the same content area load toward the same end of the dimension. Rather than impose any wishful thinking on the results, the factors shall remain unlabelled. Despite this problem of interpretation, the results reported in Figure 2 suggest that the scaling results are not meaningless.

TABLE 3
TWO-DIMENSIONAL SINDSCAL SOLUTION

Objective	Weight		Rank	
	Dimension 1	Dimension 2	Dimension 1	Dimension 2
1. Computation-L	-0.098	0.374	7	17
2. Computation-H	-0.266	0.347	3	16
3. Measurement-L	-0.260	-0.192	4	6
4. Measurement-H	-0.158	-0.197	5	5
5. Geometry-L	0.263	-0.077	15	7
6. Geometry-H	0.199	0.159	14	14
7. Graphing-L	-0.092	-0.269	8	3
8. Graphing-H	-0.143	-0.225	6	4
9. Algorithms-L	0.119	0.391	12	18
10. Algorithms-H	0.344	-0.006	17	10
11. Functions-L	0.102	0.009	11	11
12. Functions-H	0.408	-0.022	18	9
13. Probability-L	0.284	-0.409	16	1
14. Probability-H	-0.058	-0.315	10	2
15. Proof-L	0.151	0.100	13	12
16. Proof-H	-0.082	0.233	9	15
17. Applications-L	-0.274	-0.053	2	8
18. Applications-H	-0.437	0.152	1	13

In Figure 2 the graph of the loadings of individuals on the two dimensions is presented. As can be seen, there are substantial differences in the saliences of each of the dimensions for the individuals involved. MacCallum and Cornelius (1977) reported results of a Monte Carlo study which demonstrated that interpretation of individual loadings on a dimension can be misleading, as loadings alone measure goodness-of-fit of the group space to an individual's data as much as they do the salience of that particular dimension for the individual. Therefore, the appropriate method of looking for patterns among the individuals is to consider the ratio of loadings on each dimension rather than the loadings themselves. For this reason, Figure 2 has been partitioned into three zones as indicated, on the basis of angular projection from the origin. Each zone contains about equal numbers of individuals. The population of each zone is as follows: top, 10 high school, 4 vocational school,

and 9 university; middle, 7, 9, and 6; bottom, 7, 15, and 0. Remaining subjects were too close to the origin to be partitioned. This breakdown indicates that the top third contains more than its share of university teachers, and less of vocational school teachers. The reverse is true of the bottom third. If we accept the supposition that there should be some systematic differences in perception between vocational school and university teachers, then the SINDSCAL solution has found such a difference, despite our inability to attach clear labels to the dimensions of the solution.

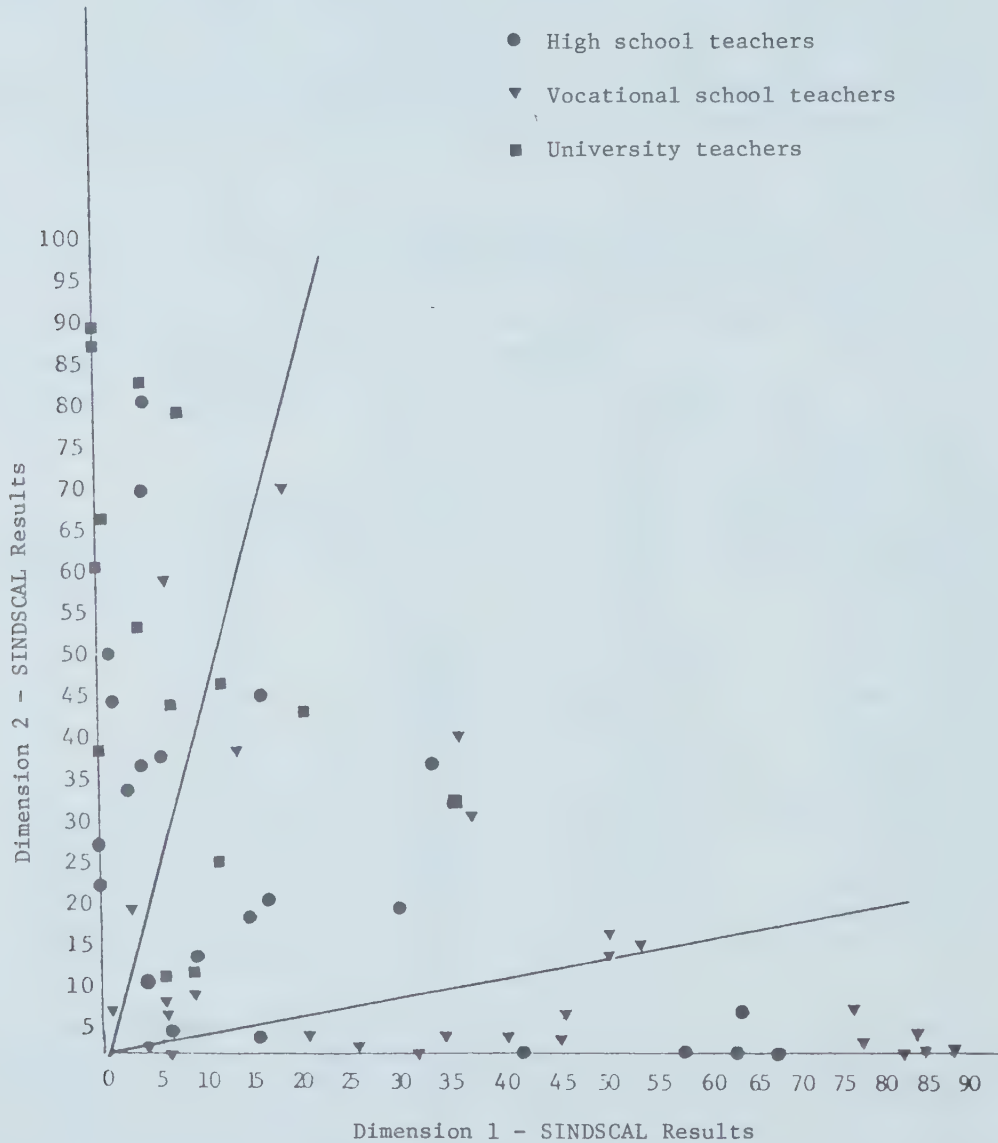


Figure 2.

In the interest of shedding light on the SINDSCAL solution, for each of the two dimensions, two individuals were chosen whose responses were best typified by the dimensions. These results are reported in Table 4. There are clearly major differences between the two pairs of individuals, but these differences defy easy interpretation. Those loading on dimension 1, high school teacher 1 and vocational school teacher 5, seemed to favour measurement, graphing, and applied

mathematics, while putting a very low priority on functions. Those loading on dimension 2, university teacher 6 and high school teacher 23, put high priority on algorithms and geometry, at the expense of measurement, graphing, probability, and applications. Clearly, more probing of the data is necessary to determine the nature of the underlying structure of the perceptions of these objectives. Unfortunately, data were collected anonymously, so that the individuals concerned could not be interviewed in an attempt to probe their reasoning.

TABLE 4
COMPARISON OF THE TWO PAIRS OF SELECTED
INDIVIDUAL PREFERENCES

	Pair 1		Pair 2	
	HS1	DVS5	U6	HS23
Loading, Dimension 1	0.66	0.84	0.00	0.04
Loading, Dimension 2	0.00	0.00	0.89	0.80
<u>Objectives & Ranks</u>				
1. Computation-L	10	9.5	2	3.5
2. Computation-H	5	6.5	2	5.5
3. Measurement-L	7.5	2	17	14
4. Measurement-H	15.5	4	14.5	17
5. Geometry-L	13	15.5	8.5	7.5
6. Geometry-H	15.5	13.5	4	1
7. Graphing-L	5	5	14.5	14
8. Graphing-H	3	9.5	13	14
9. Algorithms-L	11	17	2	2
10. Algorithms-H	15.5	13.5	6	7.5
11. Functions-L	5	12	12	10.5
12. Functions-H	18	18	10.5	9
13. Probability-L	12	15.5	18	18
14. Probability-H	7.5	9.5	16	16
15. Proof-L	15.5	9.5	10.5	5.5
16. Proof-H	9	6.5	5	3.5
17. Applications-L	2	2	8.5	12
18. Applications-H	1	2	7	10.5

The unrotated loadings for the MDSCAL group solutions are not reported. The rotated loadings, as rank orderings, are reported in Table 5, using the SINDSCAL full group solution as the rotation target. Conversion of the goodness-to-fit measures to correlation coefficients gave the following relationships between the total group SINDSCAL results and the MDSCAL results for each of the three groups: high school, 0.92; vocational school, 0.70; university, 0.66. One interpretation of these results is that the high school teachers' perceptions dominate the SINDSCAL group space more than the other groups. Referring back to Table 2, the high school teachers were the group within which there was the least agreement on priorities, which supports our earlier suggestion that perceptions are influenced by the range of interests and abilities of the students taught. Thus, we might hypothesize that their results dominated the SINDSCAL space due to their greater inter-individual variance. Such a speculation could be pursued by further analysis involving those individuals whose data did not fit the group SINDSCAL space very well.

TABLE 5
ROTATED MDSCAL SOLUTIONS (SINDSCAL TARGET)

Objective	SINDSCAL Target		High School		Vocational School		University	
	Dim 1	Dim 2	Dim 1	Dim 2	Dim 1	Dim 2	Dim 1	Dim 2
1	7	17	9	17	8	16	17	17
2	3	16	8	16	2	17	10	16
3	4	6	3	8	4	18	2	3
4	5	5	12	5	5	13	8	5
5	15	7	18	12	15	14	6	8
6	14	14	15	14	13	8	9	14
7	8	3	7	3	9	9	15	4
8	6	4	5	6	7	5	16	6
9	12	18	11	18	11	15	14	18
10	17	10	17	9	18	7	3	13
11	11	11	10	10	14	11	13	9
12	18	9	16	7	17	3	18	10
13	16	1	14	1	16	4	7	2
14	10	2	6	4	20	2	12	1
15	13	12	13	11	12	6	4	11
16	9	15	2	15	6	1	5	15
17	2	8	4	2	3	10	1	7
18	1	13	1	13	1	12	11	12

Rotation of the group MDSCAL results to each other, and subsequent conversion of the measures of fit to correlation coefficients showed the following relationships: high school with vocational school, 0.69; high school with university, 0.60; vocational school with university, 0.11. It was decided not to report the statistical significance of these correlations or of the differences between them, as it is not clear that the matrix coefficients of alienation, which form the basis for the reported correlation coefficients, have a simple sampling distribution. These results, referring back to Table 2 again, do not reflect directly the pattern of the simple correlational analysis. The present results showed the high school perceptions of priorities more closely related to those of the vocational schools than the universities, while Table 2 showed the reverse, although the differences are not large. In both analyses, the relationship between vocational school and university priorities is the lowest. Although the specific reasons for this lack of agreement are not clear, note that the correlational analysis takes into account within-group variation while the MDSCAL technique, based on group average data alone, ignores this variation. Further analysis would be needed in order to be more specific about the reason for this discrepancy.

Summary and Conclusions

In this study, there are results of both substantive and methodological interest, as well as ample room for further investigation in both realms. Simple correlational analysis showed that there were both commonalities and differences

across teachers in their perceptions of priorities in mathematics education. Neither the rank ordering nor the scaling results showed any simple pattern in the perceptions, although there was evidence of preference for objectives aimed more at the higher levels of cognitive skill. The two methods of analysis showed considerable, but not perfect, agreement in the estimation of across-group agreements.

As mentioned earlier, academic mathematics classes often consist of students with many and varied career interests. From the results of this study, it may be concluded that, as a group, teachers attempt to meet the needs of those students who attend university or a trades school. This assumes, of course, that teachers emphasize in class the objectives they report to be most important in surveys such as this, and that they have, in fact, interpreted the questionnaire items similarly. As individuals, however, many secondary school teachers appear to focus on the needs of one group more than the other. It is quite possible that the special needs of those students not pursuing a postsecondary education are not met at all in the academic program. Several curricular questions, not directly addressed in this study can now be asked. Is the curriculum so ill-defined that its objectives can be interpreted quite differently by different teachers? Is it possible to develop a curriculum that will meet the needs of such a diverse group of students? Are teachers interpreting the curriculum in a manner which meets the needs of *all* of their students and, if not, how can teacher education programs be structured to teach them to do so?

Although specific recommendations with respect to content are difficult and perhaps dangerous to make when based on data from a short list of objectives and a low response rate, several implications for teachers appear evident. Particularly for those students who aspire to attend university, more emphasis needs to be placed on higher level objectives. One specific example of this is the presentation of the function concept as a unifying theme in mathematics. For those who plan to attend a trades school, teachers should consider a greater emphasis on measurement concepts as well as applications from various trades and technologies.

If we wish to generalize from Newfoundland to other jurisdictions, it must be emphasized that, due largely to the provincial examination system in place in that province, there is more centralized curriculum control than in most other provinces. Thus, one would expect that there would be even more curricular diversity and disagreement over priorities in other jurisdictions. Such a hypothesis is, of course, subject to investigation.

The rationale for much of this type of research is that perceptions of priorities have an effect on teacher choice of topics, allocation of time, classroom behaviour, and ultimately, on student achievement. Observational studies, focussing on a smaller number of teachers, and perhaps a smaller number of objectives, would be needed to establish relationships of this type. In this study, these links remain unexamined.

With this and similar data sets, however, further analysis is possible. For example, it may be possible to find relationships among other teacher variables and perception of priorities. As already mentioned, an obvious supplementary analysis is to run SINDSCAL on the data from each of the three groups separately. This would probably, given the low degree of agreement across groups, result in substantially different group spaces. There is potential further

information in the data of those individuals who did not fit the group SINDSCAL space very well. These teachers may be marching to the beat of quite a different drummer.

Those individuals who show a wide variation in their preferences for objectives would tend to dominate the group average preferences which were the input to the MDSCAL analysis. Consideration should be given to the possibility of normalizing, within the individual, before averaging.

Other data gathering techniques, involving sorting of objectives into various categories or placing them on a board, although requiring more intensive effort by respondents, may be useful in discovering the underlying reasons for the perceptions of priorities. For example, see Champagne, Klopfer, Desema and Squires (1981), Preece (1976), or Shavelson and Stanton (1975), for discussion of tree diagram construction, hierarchical classification, and other methods.

A word concerning paired comparisons and multidimensional scaling as the analytic tools of choice in this study is appropriate. Commenting on an earlier version of this report, Traub (1981) suggested, in part, that information on perceptions of priorities could be gleaned more easily, and perhaps more accurately, by asking subjects for a simple rank order of priorities among a relatively small number of objectives rather than by asking for a considerably larger number of paired comparative judgements. One could then proceed through correlational analysis of rank orders, and perhaps through averaging within groups of the rank orders of individuals, and produce very similar results to those reported here without resorting to the scaling analysis at all. With reference to the SINDSCAL dimensions which we have chosen to leave unlabelled because of their correlations with the simple preference rankings of Table 1, he suggested that they both be labelled "importance," but "importance from different points of view."

His comments are to the point, and raise the general issue of "why bother" with scaling analysis when less complex methods are readily available. Our answer is that the goal of a study such as this is to attempt to find a more precise definition of the different points of view of different judges of priority. In other words, the purpose is to uncover the implicit meanings of importance which a judge brings to the task. In the present case, the attempt has not been notably successful except to show that the issue is not clearcut. What is needed in a long range program of research in this area is information which validates and elucidates the scaling results, perhaps using interview methods. This, combined with a series of scaling studies, has the long range potential of shedding enough light on the behaviour of scaling algorithms that they will move beyond the stage of developing methodology and begin to make contributions to substantive understanding which other methodologies are incapable of making.

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References

- Carroll, J. D., & Chang, J. J. An analysis of individual differences in multidimensional scaling via an N-way generalization of "Eckart-Young" decomposition. *Psychometrika*, 1970, 35, 283-319.

- Carroll, J. D., & Wish, M. Multidimensional perceptual models and measurement methods. In E. C. Carterette & M. P. Friedman (Eds.), *Handbook of Perception: Vol 2 — Psychophysical Judgment and Measurement*. New York: Academic Press, 1974.
- Champagne, E. B., Klopfer, L. E., Desema, A. T., & Squires, D. A. Structural representation of students' knowledge before and after science instruction. *Journal of Research in Science Teaching*, 1981, 18, 97-111.
- Fullan, M., & Pomfret, A. Research on curriculum and instruction implementation. *Review of Educational Research*, 1977, 47, 335-397.
- Kruskal, J. B. Multidimensional scaling by optimizing goodness of fit to a nonmetric hypothesis. *Psychometrika*, 1964, 29, 1-27. (a)
- Kruskal, J. B. Nonmetric multidimensional scaling: A numerical method. *Psychometrika*, 1964, 29, 115-129. (b)
- Kruskal, J. B., & Carmone, F. How to use M-D-SCAL (Version 5M) and other useful information. Murray Hill, N.J.: Bell Telephone Labs, 1971.
- Lingoes, J. C., & Schonemann, P. H. Alternative measures of fit for the Schonemann-Carroll matrix fitting algorithm. *Psychometrika*, 1974, 39, 423-427.
- MacCallum, R. C. Relations between factor analysis and multidimensional scaling. *Psychological Bulletin*, 1974, 81, 505-516.
- MacCallum, R. C., & Cornelius, E. T. A Monte Carlo investigation of recovery of structure by ALSCAL. *Psychometrika*, 1977, 42, 401-428.
- Preece, P. F. W. Mapping cognitive structure; A comparison of methods. *Journal of Educational Psychology*, 1976, 68, 1-8.
- Priorities in School Mathematics: Executive Summary of the Prism Project*, National Council of Teachers of Mathematics, Reston, Virginia, 1981.
- Pruzansky, S. How to use SINDSCAL: A computer program for individual differences. Murray Hill, N.J.: Bell Telephone Laboratories, 1975.
- Schonemann, P. H., & Carroll, R. M. Fitting one matrix to another under choice of a central dilation and a rigid rotation. *Psychometrika*, 1970, 35, 245-255.
- Shavelson, R. J., & Stanton, G. C. Construct validation: Methodology and application to three measures of cognitive structure. *Journal of Educational Measurement*, 1975, 12, 67-86.
- Traub, R. E. Discussant's remarks for a symposium: Multidimensional scaling applications in educational evaluation. Presented at the Annual Meeting, Canadian Educational Research Association, Halifax, 1981.
- Worth, J. et al. *Prism Canada (Priorities in School Mathematics)*. University of Alberta, Edmonton, 1981.

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Subject-Object and Subsystems Interactions in Problem Solving

This experiment is an attempt to test Piaget's (1977) notion of "subject-object" and "subsystem" interactions in problem solving. A subject-object interaction, which is here suspected of accounting for variance in problem solving, is that between the amount of haptic experience with the objects of a problem and the ability to anticipate transformations of the mental images of those objects (spatial ability). A subsystems interaction, which is here hypothesized also to account for variance in problem solving, is that between the ability to reproduce static images of the objects (static imagery) to the problem and the ability to anticipate transformations of that same image. The statistical analysis of the experimental data suggests significant haptic/non-haptic by spatial ability interaction and a static imagery by spatial ability interaction accounting for variance in problem solving scores. These statistical interactions are interpreted as substantiation of the hypothesized Piagetian interactions.

Little has been done to integrate Piaget's notions of problem solving (Piaget, 1977) and mental imagery (Piaget & Inhelder, 1971) with other theoretical frameworks of problem solving (e.g., Guilford, 1967) and spatial abilities (McGee,

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1979; Smith, 1964). It is the intent in this paper to investigate that relationship in the context of data collected to test Piagetian notions.

Piaget's (1977) concept of equilibration may serve as a basis for understanding problem solving. A problem in this framework is the disequilibration that may occur as a result of either a subject-object interaction or an interaction of the subject's subsystems (action or conceptual schemes). Guilford (Guilford, 1967; Guilford & Hoepfner, 1971), on the other hand, alludes to problem solving as consisting of fifteen factors in a factor analysis structure of intellect model. This descriptive model involves mainly the transformation of semantic material and provides little understanding for problem solving processes in general. Consequently, it would be interesting to test a Guilford-style problem solving instrument (e.g., "Predicaments") against Piagetian constructs. A test of greater reliability ("Uncommon Predicaments") was developed by the authors for this purpose.

Guilford's results would suggest that one's problem solving ability is basically an ability to transform semantic material, while Piaget would suggest that one's problem solving ability depends on one's level of operativity. This operativity is related to the ability to make transformations both on semantic and imagery content. Consequently, in Piagetian terms, a measure of one's operativity obtained through tests of spatial ability (i.e., a test of one's ability to transform mental images) should be a predictor of solution rates of verbally stated problems. In addition to this, Piagetian theory would predict significant effects due to the interaction of subsystems and to subject-object interaction affecting problem solution rates. It is expected that these theoretical subject-object and subsystem interactions reveal themselves statistically as treatment by ability and as ability by ability interactions, respectively.

A subsystems interaction of interest in this study is between the structure that can generate a mental image and the operative structures that can transform the image. In a test of verbally stated problems involving concrete objects, use of imagery and transformation of that imagery is advantageous (Paivio, 1971, 1976; Smith, 1964). Piaget and Inhelder (1971) suggest that at the lowest level of development of mental imagery a person is able to reproduce an image of an object that had been previously seen. At the highest level of development of imagery, a person is able to anticipate a transformation of an image. These anticipatory transformations themselves are linked directly to the person's operational level. In statistical terms, a test score of anticipatory transformational imagery, partialling out reproductive, static imagery with an appropriate test score, would be a measure of one's operational level. However, in the absence of an ability to reproduce static images, operative structures have little on which to act. So, in a problem situation where an anticipatory transformation of an image may be advantageous, higher problem solving rates will occur in the presence of both static imagery abilities and higher operational level. The absence of either or both static imagery ability and higher operational level will result in lower problem solving scores. This would reveal itself statistically by the interaction of a static imagery test score (henceforward called "imagery score" for brevity) with an anticipatory, transformational imagery test score, partialling out the imagery score (henceforward called "spatial score" for brevity).

A subject-object interaction was of interest in this study. This involved the subject's tactual-manipulative (haptic) interaction with objects that were

subsequently used in the uncommon predicament written test. Piaget (1954) believed that a child's construction of space (near-far, up-down, left-right) evolves primarily out of the child's manipulation of his/her environmental objects, rather than through vision. While the construction of spatial structures may occur primarily through manipulation, vision does play a role in developing spatial abilities (Hartlage, 1976). Salkind (1976) indicated that spatial visualization is "enhanced by input from the haptic sensory mode." So it was suggested that not only are spatial structures, and hence operative structures, constructed primarily via manipulation but also that they seem to be stimulated by that same modality as well. Data collected by Anderson and Johnson (1966) and by Glucksburg (1964) for other purposes suggested as well that hands-on experience with objects increases solution rates of problems involving those same objects over and above simply seeing those same objects. The cognitive construction of space, mental imagery, and spatial abilities hinges primarily on the development of operative action and cognitive structures, which in turn are reflected by a person's problem solving ability. It is expected that unsighted, haptic manipulation of the objects used in the problem will stimulate spatial structures used for subsequent problem solving. Statistically this will reveal itself as an interaction of a haptic/non-haptic treatment contrast by spatial score, predicting problem solution rate.

In summary, the present experiment is intended to test hypotheses concerning two interactions. First, an imagery by spatial interaction is expected, where those high both in imagery score (static, reproductive imagery) and in spatial score (transformational anticipatory imagery with static, reproductive imagery partialled out) will do better than other combinations of these two scores. Second, a spatial by haptic/non-haptic treatment contrast interaction is expected, where haptic (tactual) manipulation of the objects mentioned in Uncommon Predicaments test stimulates the spatial structures subsequently used in solving problems on this test. This will be revealed statistically by the fact that the slope of the regression line of spatial score predicting problem solving is greater for the haptic group than the non-haptic group.

This investigation is limited to testing solely the above two specific hypotheses concerning interactions. The numerous experimental and statistical controls that were required to test these interactions may unfortunately distract the reader from these central issues. Tests for interactions require seeking differences in *correlations* across groups or across levels of abilities, rather than differences in *central tendency* across groups. It is common in educational research to do the latter and uncommon to do the former, which is the intent of this experiment.

Method

Several controls were included in the design of this experiment. A questionnaire was designed to assess the recency and extent of involvement of the subjects with the objects mentioned in the problem solution sets. Also a second control group was included. The first control group had no intervention between pretests and posttest. The second control group was shown the objects used in the response of the problem solving posttest. These subjects also described or were told how the object is commonly used. This second control group is hereafter called the Functional-Visual (FV) group. The intent of the FV group was to control for awareness of the functional and figural aspects of the objects used in the solution set of the problem solving post test.

Sample

Forty-two undergraduate education students enrolled in an introductory educational psychology course, plus 33 graduate students enrolled in a statistics course for the behavioral sciences offered by the Department of Guidance and Educational Psychology at Southern Illinois University served as subjects. About half of the graduate students were doctoral, education students; about a third were doctoral, social sciences students; and the remainder were doctoral, biological sciences students. The sample ages had a mean of 24.5 years, and a median of 22.9 years, with a minimum of 19 years and a maximum of 59 years. There were 29 males and 46 females in the sample. Students were given course credit for participation.

Materials

1. Two tests (Form A & B) of verbally-stated problems involving concrete objects, called "Uncommon Predicaments," were developed by the authors. The design evolved from Guilford's (1967; Guilford & Hoepfner, 1971) *Predicaments* test with the additional requirement that many of the objects of the problems were commonly seen but not manipulated. The authors designed the test with the intent (albeit without empirical support) that imaginal rather than semantic transformation would be required for problem solution. Tests involved the solution of a stated problem by use of two objects selected from a set of four.

Example

Cook a fish when matches are available.

(a) Books (b) A shoe (c) A portable AM/FM radio (d) A shirt

Answer: (a) and (c). Reason: The antenna from the radio could skewer the fish, while the books could make a fire.

Each form had eight such questions. The examinee was to circle the choice of two objects and write a reason for the choice. The score was based on feasibility, efficiency, and clarity, and ranged from 0 to 3 for each question. A maximum score of 24 was possible. Scoring was done by two judges. Interjudge reliability (Pearson r) based on 17 scripts taken at random was 0.85 for Form A and 0.96 for Form B. Form B was the dependent variable, while Form A (pretest) was used as a covariate. The tests were not timed.

2. The test of spatial abilities used was Part I of the *Paper Folding Test*, a subtest of the kit of Factor-Referenced Cognitive Tests E.T.S. (French, Ekstrom & Price, 1963). Das, Kirby and Jarman (1975) report a major loading with the simultaneous processing factor, which in turn related significantly with "spatial abilities" (Kirby & Das, 1978). The test demands that one fold and unfold in one's imagination, hence make three dimensional transformations of images. The test requires the ability to make anticipatory transformations of static images.
3. The test of imaginal abilities was Part I of the *Form Board Test*, a subtest of the Kit of Factor-Referenced Cognitive Tests, E.T.S. (French, Ekstrom & Price, 1963). Forisha (1975) found a major loading with her imaginal factor, and no significant correlation with her spatial factor. The test requires the ability to generate and hold a static image for subsequent use without having to make a three-dimensional transformation of the image.

4. A Previous Experience Questionnaire listed the names of the objects used in the response sets of Uncommon Predicaments, Form B. The examinee placed a number from 0 to 5 for each object, which indicated the recency and extent of his/her experience with the object. The sum across the 17 objects indicated the degree of previous experience with the set of objects and was used as a covariate.

Procedure

Across the three groups, balance was kept with respect to the number of graduates and undergraduates. Selection of examinees for a given group was random. The procedure for each group was as follows:

Haptic Experience Group: Examinee took *Uncommon Predicaments* Form A, *Form Board Test* Part I, *Paper Folding Test* Part I, and *Previous Experience Questionnaire*. Thereafter, examinee was blindfolded, led into another room and given each of the objects mentioned in the response sets of *Uncommon Predicaments* Form B to hold and manipulate. S(he) was then asked to describe the parts of the object as to shape, material, and texture, and then to count the number of parts. Finally, the examinee was to guess what the object was. If the examinee did not know, s(he) was told the name. After being led out of the room, the examinee took *Uncommon Predicaments* Form B. At no time during the intervention did the examinee have visual contact with the objects.

Control Group: The examinee took *Uncommon Predicaments* Form A, *Form Board Test* Part I, *Paper Folding Test* Part I, *Previous Experience Questionnaire*, and then *Uncommon Predicaments* Form B. Examinees had no recent interaction with the objects mentioned in *Uncommon Predicaments* Form B.

Function-Visual (FV) Group: The examinee took *Uncommon Predicaments* Form A, *Form Board Test* Part I, *Paper Folding Test* Part I and *Previous Experience Questionnaire*. Thereafter, s(he) was led into another room and shown, one at a time, each object mentioned in the response sets of *Uncommon Predicaments* Form B, with instructions to write down the name of the object as given by the experimenter. The examinee was then asked what the usual function of the object is. If the examinee did not know, s(he) was told. After all objects were seen (but not handled), the examinee was directed to another room where s(he) took *Uncommon Predicaments* Form B.

The experiment was conducted for each examinee individually. Time required was about one hour each. Sex, age, major subject, and grade level (graduate, undergraduate) of each examinee were recorded.

Results

A general linear model via multiple regression was used to analyze the data. Forms of *Uncommon Predicaments*, Sex, and the *Previous Experience Questionnaire* were included in the model as covariates. Imagery, Spatial Abilities, Haptic Effect (an orthogonal comparison between the haptic experience group and the remaining groups), FV-Effect (an orthogonal comparison between the Functional-Visual group and the Control Group) were included as main effect independent variables. Standard Z scores were used for all independent measures. The two treatment effects were contrast coded using orthogonal coefficients (Kerlinger & Pedhazur, 1973). First order interactions (a) Haptic Effect x Imagery, (b) Functional-Visual Effect x Imagery, (c) Haptic Effect x Spatial, (d)

Functional-Visual Effect x Spatial, and (e) Spatial x Imagery were included. Although main effects were expected, the primary effects of interest were (a) Haptic x Spatial interaction, and (b) Spatial x Imagery interaction.

TABLE 1
SS AND *F* VALUES FOR THE INDEPENDENT VARIABLES
IN THE GENERAL LINEAR MODEL^a

Source	Independent SS	MS	<i>F</i> (df=1,61)
a. Sex	116.007	116.007	15.27*
b. Form A	372.7697	372.7697	49.05*
c. Previous Experience Questionnaire	42.8776	42.8776	5.64*
d. Imagery	47.5475	47.5475	6.255*
e. Spatial	36.4468	36.4468	4.794*
f. Haptic/non-Haptic	53.225	53.225	7.005*
g. FV/Control	3.0818	3.0818	0.404
h. Spatial-Quadratic	21.9655	21.9655	2.889
i. Imagery × Spatial	38.9468	38.9468	5.123* ^b
j. Haptic × Imagery	15.2988	15.2988	2.011
k. Haptic × Spatial	50.834	50.834	6.686* ^b
l. FV × Imagery	43.0663	43.0663	5.665*
m. FV × Spatial	.0786	.0786	0.009
(Common Variability)	(266.5266)		
Error	463.635	7.478	
Total	1572.337		

* $p < .05$
^a Full Model $R^2=70.5\%$ $F=11.22$ $df=(13,61)$ $p<0.0001$
^b Primary Research Interest

The least squares solution of sums of squares for the general linear model appear in Table 1. Shown are the independent contribution of the independent variables in terms of sums of squares and the resulting *F* test for the various effects. As indicated in Table 1, the main effects of Imagery, Spatial Abilities and Haptic/non-haptic contrast were statistically significant (all $p<.05$). Of more interest to this study, however, were the significant interactions of Haptic x Spatial, and Imagery x Spatial (all $p<.05$). Also, the FV x Imagery interaction was observed ($p<.05$).

The least squares solution of the sample data yielded regression results as depicted in Figures 1, 2, and 3, which are two-dimensional sections of a four-dimensional hyper-surface. For purposes of display, the Imagery and Spatial variables are depicted in *Z*-score form with range from $Z=-1.5$ to $Z=1.5$. For purposes of discussion, high Spatial will refer to the point on the regression solution at $Z=1.5$, while low Spatial will refer to the regression solution at $Z=-1.5$. Analogously, reference is made to high and low Imagery.

The Haptic x Spatial interaction ($F=6.86$; $df=1, 61$, $p<.05$) appears in Figure 1. As hypothesized, high Spatial subjects who experienced Haptic stimulus performed well ($\hat{Y}=14.95$), while their high Spatial counterparts who were not allowed Haptic experience (Control and FV Groups) did not fare as well ($\hat{Y}=11.197$). Low Spatial subjects appeared to perform the same under the Haptic condition ($\hat{Y}=8.76$) as under the non-haptic condition ($\hat{Y}=8.80$).

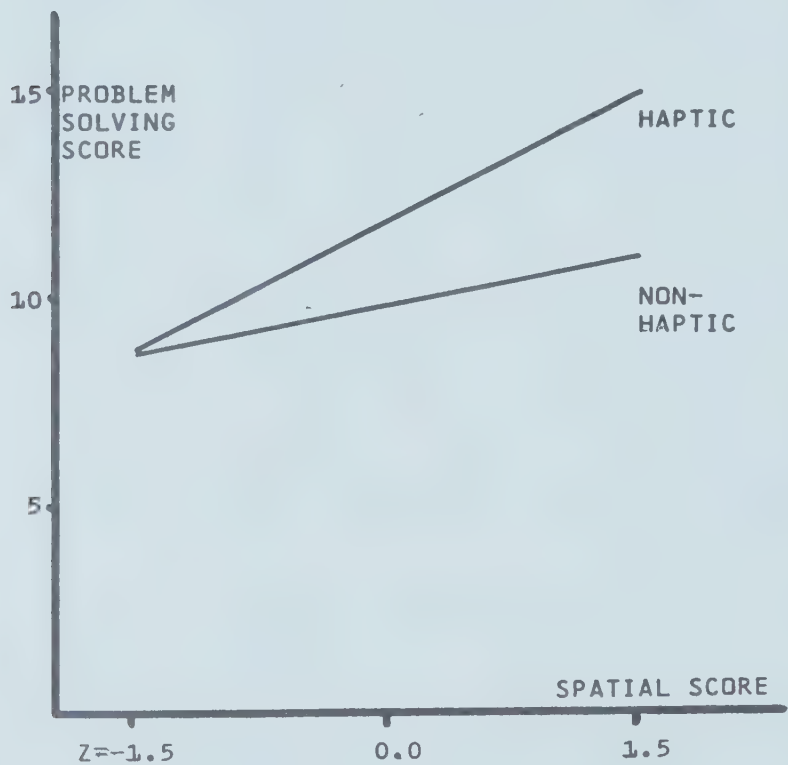


Figure 1. The Haptic Effect by Spatial Abilities Interaction.

The interactive relationship of spatial ability and imagery with problem solving is depicted in Figure 2 ($F=5.123$, $df=1,61$, $p<.05$). The highest solution rate ($\hat{Y}=13.57$) was observed for high spatial-high imaginal subjects. High spatial subjects with low imaginal ability yields lower estimate ($\hat{Y}=10.84$) as expected. The higher solution rate of low spatial-low imagery subjects ($\hat{Y}=9.98$) in comparison to the low spatial-high imagery subjects ($\hat{Y}=6.76$) was an interesting outcome. The slope for the low imagery section indicates that problem solving was independent of spatial abilities in the presence of poor imagery.

Figure 3 shows the interaction observed between the Functional-Visual Effect and Imagery ($F=5.665$, $df=1, 61$, $p<.05$). The treatment effect appeared to make their rate of problem solving independent of imagery. The correlation (Table 2) between the imagery score and the problem solving posttest was $r=-0.079$ ($p>.50$) for the FV group and $r=0.395$ ($p<.05$) for the non-intervention control group.

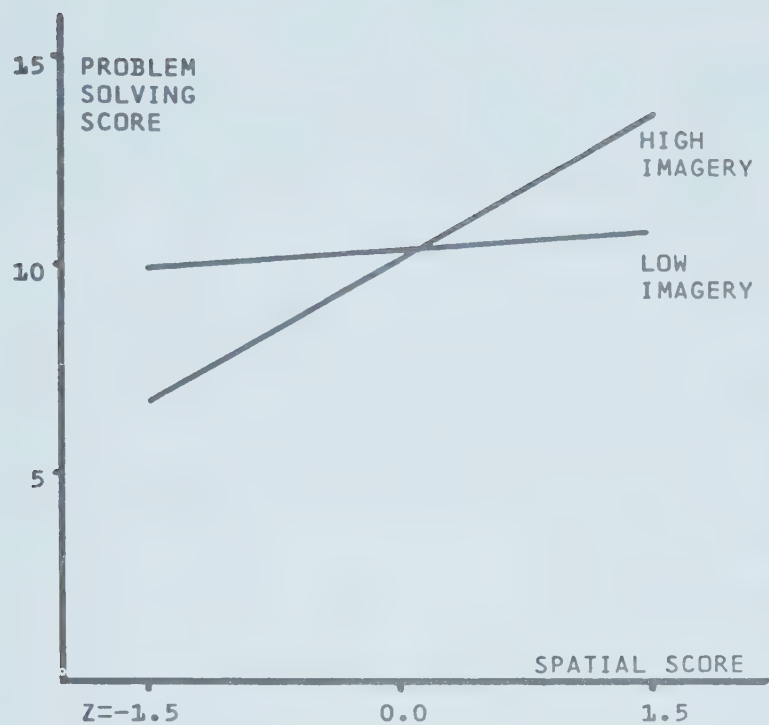


Figure 2. The Spatial by Imagery Abilities Interaction.

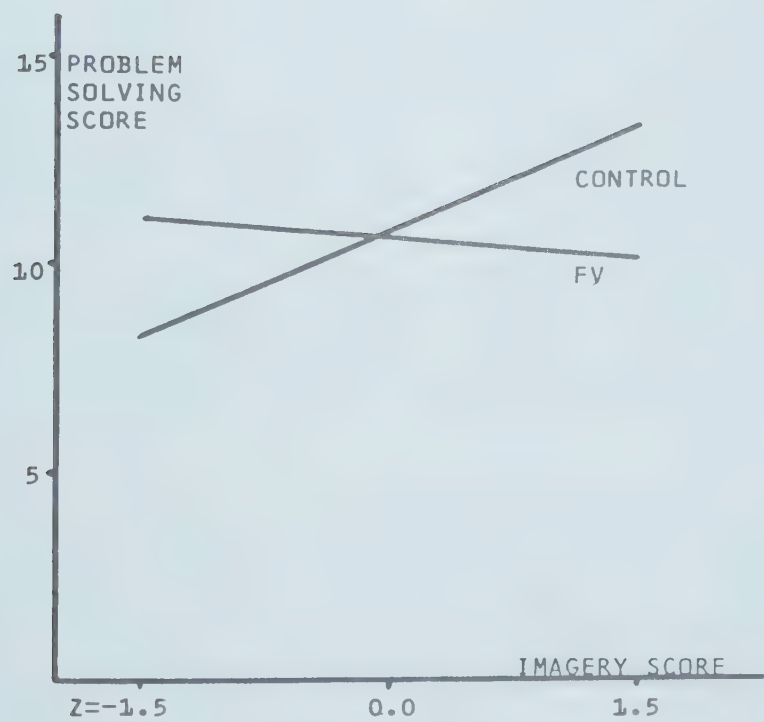


Figure 3. The Functional-Visual Effect by Imagery Interaction.

TABLE 2
CORRELATIONS

	Posttest	Imagery	Spatial
<u>Haptic Group (<i>N</i> = 25)</u>			
Pretest	0.693*	0.281	0.217
Posttest		0.166	0.499* (.42) ^a
Imagery			0.455*
<u>Control Group (<i>N</i> = 25)</u>			
Pretest	0.858*	0.273	0.238
Posttest		0.395*	0.300
Imagery			0.717*
<u>FV Group (<i>N</i> = 25)</u>			
Pretest	0.368*	0.167	0.000
Posttest		-0.079	0.023
Imagery			0.576*

* $p < 0.05$ ^a Semi-partial with Imagery partialled out.*Discussion*

The results presented above are consistent with Piaget's (1977) notion of subject-object and subsystem interaction in cognitive process. It is apparent from Figure 2 that spatial structures have been stimulated, or activated, by haptic manipulation of concrete objects of a problem. This concurs with Piaget's (1954) idea that the cognitive construction of space begins through one's manipulation of the objects in one's environment. Salkind's (1976) contention, that spatial visualization is enhanced by Haptic "input," has also been confirmed (among adults in this sample).

The "subsystems" interactions postulated by Piaget (1977) also appeared in these results as an imagery by spatial interaction. In this case, the dependence of problem solving on spatial abilities (i.e., a structure to transform a static mental image) was a function of imagery ability (i.e., a structure to form and hold a static mental image). This is now a logical result, but one that has not been tested until the present.

The result that indicates an interaction of FV treatment (contrasted with the non-intervention control) with the static imagery score is indeed interesting. Apparently, of the three groups only the non-intervention control group had its posttest score correlated with the static imagery score. As well, the only group whose posttest score was correlated with the spatial score was the haptic group, while neither the imagery nor the spatial score correlated with the posttest for the FV group. That is, there is no evidence to suggest that the FV group used imagery to solve the verbally stated problems of *Uncommon Predicament Form B*. Therefore, a logical deduction based on Piagetian notions, which may serve as an

hypothesis for future research, is that the FV group solved the problems via semantic transformations.

In conclusion, this experiment and subsequent statistical manipulations of the data serve as another bit of evidence to lend support to the Piagetian concepts of subject-object interactions and subsystem interactions. As well, the experiment points to antecedent conditions that appear to stimulate imaginal structures.

References

- Anderson, B., & Johnson, W. Two methods of presenting information and their effects on problem solving. *Perceptual and Motor Skills*, 1966, 23, 851-856.
- Das, J. P., Kirby, J., & Jarman, R. F. Simultaneous and successive synthesis: An alternative model for cognitive abilities. *Psychological Bulletin*, 1975, 82(1), 87-103.
- French, J., Ekstrom, R., & Price, L. *Kit of reference tests for cognitive factors*, Princeton, New Jersey: Educational Testing Service, 1963.
- Forisha, B. D. Mental imagery, verbal processes: A developmental study. *Developmental Psychology*, 1975, 11(3), 259-267.
- Glucksburg, S. Functional fixedness: Problem solution as a function of observing responses. *Psychonomic Sciences*, 1964, 1, 117-118.
- Guilford, J. P. *The nature of intelligence*. New York: McGraw Hill, 1967.
- Guilford, J. P., & Hoepfner, R. *The analysis of intelligence*. New York: McGraw Hill, 1971.
- Hartlage, L. C. Development of spatial concepts in visually deprived children. *Perceptual and Motor Skills*, 1976, 42, 255-258.
- Kerlinger, F. N., & Pedhazur, E. J. *Multiple regression in behavioral research*. New York, Holt, Rinehart and Winston, 1973.
- Kirby, J. R., & Das, J. P. Information processing models and human abilities. *Journal of Educational Psychology*, 1978, 70(1), 58-66.
- McGee, M. G. Human spatial abilities: Psychometric studies and environment, genetic, hormonal, and neurological influences. *Psychological Bulletin*, 1979, 86(5), 889-918.
- Paivio, A. *Imagery and verbal processes*. New York: Holt, Rinehart, and Winston, 1971.
- Paivio, A. Concerning dual-coding and simultaneous-successive processing. *Canadian Psychological Review*, 1976, 17(1), 69-71.
- Piaget, J. *The construction of reality in the child*. New York: Basic Books, 1954.
- Piaget, J. *The development of thought*. New York: Viking Press, 1977.
- Piaget, J., & Inhelder, B. *Mental imagery in the child*. New York: Basic Books, Inc., 1971.
- Salkind, N. J. A cross-dimensional study of spatial visualization in young children. *Journal of Genetic Psychology*, 1976, 129, 339-340.
- Smith, I. M. *Spatial ability*. London: University of London Press. 1964.

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Cognitive Processes and Achievement

Measures on reading, spelling, and mathematics were obtained for 149 students who had previously been identified as either high or low scorers on the dimensions of the Luria model involving sustained attention and simultaneous-successive processing. The reading, spelling, and mathematics variables were analyzed in a multivariate and univariate analysis of variance design, with levels of sustained attention and simultaneous and successive processing as the independent variables. All the achievement variables were significantly related to the sustained attention and simultaneous and successive factors; however, an interaction was obtained for the spelling and reading variables. The results were interpreted in terms of the Luria model.

Under the influence of information processing and cognitive models of learning, instructional design has recently changed from its traditional role of that of improving the effective acquisition of content, to one that includes the modification and optimization of the processes available to the learner for successful completion of a particular task (Biggs, 1978; Merrill, Kowallis, & Wilson, 1981). Messick (1973) suggested the cognitive processes approach rather than the conventional cognitive abilities approach in the design of instruction; these ideas, together with the aptitude treatment interaction model proposed by Cronbach (1967) encouraged researchers to pursue the relationship between process and achievement (Rothkopf, 1970; Pask & Scott, 1972) and to examine the prospect of process modification (Krywaniuk & Das, 1976; Leasak, Hunt & Randhawa, 1982). One model of cognitive

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processing that has been used in investigations of this kind is the one proposed by Luria (1966, 1973).

In Luria's model (1966, 1973), information is processed under the coordinated influence of three functional systems: arousal, processing, and planning. The arousal system has an activating or inhibiting function, whilst the processing system engages in two forms of activity—simultaneous and successive processing. The link between the arousal system and attention is complex (Lewis & Baldine, 1979). Dykman, Ackerman, Clements and Peters (1971) have suggested that attention consists of the interrelated components of alertness, stimulus selection, focussing, and vigilance. The term vigilance, which is a physiological and psychological readiness to respond, has been defined as that behaviour required to attend to relevant stimuli and ignore irrelevant stimuli over a period of time (Mackworth, 1970). Sustained attention, as operationalized in the present study, is obviously closely related to vigilance which in turn is related to the Luria arousal system in that one manifestation of the Luria functional system will be a variation in vigilance when the subject is involved in a cognitive task. Simultaneous processing, on the other hand, is the integration of individual stimuli into spatial or quasi-spatial groupings, whilst successive processing involves the integration of stimuli in a temporally organized fashion. The processing unit has been operationalized by Das, Kirby and Jarman (1975). The planning unit, essentially a metafunction, concerns itself with the utilization of coded material for achieving a particular goal. Ashman and Das (1980) developed tests to operationalize this component.

The Luria model does not predict simple relationships between the functional units and achievement outcomes and the research results bear this out. For instance, a separate achievement factor emerged when achievement results and processing scores were factor analyzed (Das, 1973). Das, Manos and Kanunga (1975) concluded that both successive and simultaneous processing were important if students were to be generally successful in reading and that the better readers relied more on simultaneous processing. Kirby and Das (1977) demonstrated that those students who measured high in both simultaneous and successive processing also measured high in reading, though neither by itself was sufficient for high achievement. Hunt (1980), in a study of intentional-incidental learning, showed that subjects who were high on the simultaneous factor processed more incidental information. The simultaneous factor has also been found to be related to the long term retention of verbal material (Hunt, Fitzgerald & Randhawa, 1975). What appears to emerge from the research in this area is that the interaction of these processes is complex and is not only dependent upon whether the individual has other processes at his/her disposal to use at his/her option for the attainment of a particular goal, but also dependent upon whether the nature of the task itself requires specific processes for its completion. For example, it could be argued that because arithmetic is dependent upon the ability to survey various parts of the problem as a whole, students high in simultaneous processing should be better at these tasks provided that they are able to deploy this process effectively. Here, obviously, is the link with the planning units mentioned earlier. Hunt (1980) showed that there is a significant interaction between intentional and incidental learning variables and a measure of sustained attention, but no research has looked at the interaction of processing and achievement outcomes. In this regard, it could be hypothesized that when subjects do not have one or the other of the processing units at their disposal, and the task demands the effective deployment

of these units, then provided there is a sufficient amount of sustained attention the goal may be reached, albeit not so efficiently, by relying more on the process that is available. This might not be so in the case of an insufficient amount of sustained attention.

In the present study an attempt has been made to examine the interaction of the processing units and sustained attention with achievement variables.

Method

Subjects

The subjects were 165 students comprising the whole of Grades 4 and 5 in one school in Armidale, New South Wales. The mean CA was 130 months.

Tests

The following tests were administered to 165 students. The tests administered normally comprise the simultaneous-successive battery as used in other reported studies, with the addition in this instance of an additional test to measure sustained attention. All tests were administered as group tests by the senior author.

Matrix test. This test was originally developed by Fitzgerald (1971). The test consists of two groups of 20 shapes with each shape drawn on a three by three dot matrix. The test was refined for the present study by analyzing each item for discrimination and difficulty on a separate sample of students. KR-20 reliability coefficients for each part of the test were .79 and .72 respectively. The first part of the test (Matrix A) consists of the momentary presentation (5 seconds) by slide of each shape, after which the student is required to reproduce the shape on a supplied dot matrix. The second part of the test (Matrix B) consists of the presentation of the rest of the shapes in the same manner, but in this instance the student is required to reproduce on the dot matrix supplied the pattern rotated 90 degrees to the right. The matrix test was developed from the statement that disturbance of spatial synthesis is especially prominent when the patient is asked to invert and then draw a presented figure (Luria, 1966), and should be a measure of simultaneous processing. The score for each test was the number correctly reproduced.

Copying test. This test was adopted from the copying test of the French, Ekstrom and Price (1963), Kit of Reference Test for Cognitive Factors. The student is given a pattern and asked to reproduce the pattern in a supplied 5 x 5 dot matrix. In this test the student is allowed to view the original pattern the whole time. This test, like the Figure copying test (Ilg & Ames, 1964) used by Das (1973), should give a measure of simultaneous processing. The score was the number correctly copied.

Digit Span Test. This test consists of the oral presentation by tape of a series of numbers varying from 4 to 12 digits in length. The student is required to write down the numbers when the series is finished. Unlike the Digit Span used by Das (1973), this test does not present the lists of digits in increasing length, but varies the length randomly over the 24 presentations.

Letter Span Test. This test is identical to the digit span test except letters are used. Both tests were selected from the French et al. (1963) Kit of Reference Tests for Cognitive Factors. The scoring for both tests was the number of digits or letters given in the correct order irrespective of intrusions. Both the letter and digit span tests define successive processing.

Hidden Figures Test. The original two form test of 36 items was reduced by item analysis to one test of 22 items. Items which did not differentiate between successive and simultaneous factors were disregarded. In this test the student is presented with a complex figure and asked to name which one of four simple figures, given at the top of the page, is contained within the complex figure. Because of the requirement of holding, and in some cases inverting a presented figure, this test becomes primarily simultaneous in nature.

Word String Test. This test consists of 20 strings of words presented by tape recorder, at intervals of one second. At the end of each string, the student is required to recall and write down as many of the words as possible. This test is similar to the serial recall tests used by Das (1973) except that Das used 24 lists of four words whilst this test uses 20 lists varying in length from 3 to 8 words presented in random order. Both tests should be tests of successive processing. The scoring of this test was identical to the scoring of the digit and letter span tests.

Digit/Letter Attention Span Test. This test consists of the oral presentation by tape of 20 strings of letters and digits. Each string is comprised of a random mixture of letters and digits of varying length and each presentation is preceded by the word, *letters* or *digits*. Depending upon the given instruction, the student is required at the end of each string to write down the appropriate letters or digits. Because the student is required to listen for specific stimuli given within irrelevant material, this test should give a measure of sustained attention. The scoring was the number of digits or letters given in correct order irrespective of intrusions.

Achievement Battery. The Gapadol Reading Test (McLeod & Anderson, 1970) was used as a means of reading comprehension. Three subtests of the New South Wales evaluation programme developed jointly by the Australian Council for Educational Research and the New South Wales Department of Education was used to obtain measures of achievement in mathematics and spelling (New South Wales, 1971). The two mathematics tests consist of approximately 50 multiple-choice items in each. The first test measures the basic understandings involved in the operations on counting numbers, whilst the second test measures the underlying principles of rational numbers. The spelling tests consisted of 40 words developed for Grades 4 and 5.

Design

The intercorrelations among the nine variables were subjected to an unrestricted common factor analysis using the COSA programme of McDonald and Leong (1976). Confirmatory factor analysis uses existing theory as a reference against which empirical data are tested. Essentially it is based on an unrestricted factor model where the number of factors is testable using a maximum likelihood method. Models of 2, 3 and 4 factors were tested. A 3-factor structure was acceptable [$X^2(12)=10.7$, $p<.05$]. The reader is referred to McDonald (1978) for further details. The resulting factor solution was subjected to a varimax rotation. The factor structure is given in Table 1.

Achievement data were obtained on 149 students and the factor scores for each of these students on the three factors were obtained. A median split of these scores for each factor was taken so that each student was categorized on a high-low dichotomy on each factor. The achievement variables were then analyzed

in a 2 (high-low simultaneous) x 2 (high-low successive) x 2 (high-low attention) multivariate (MANOVA) and univariate (ANOVA) analysis of variance. Because of the differences in cell sizes, the MANOVA and ANOVA effects were tested conservatively by entering a particular effect last in the analyses. Humphreys (1978) suggested that with data of this nature a more powerful test is to use a regression model rather than an analysis of variance model. In the present study, both analyses were attempted, but as almost similar results were obtained, the more conservative results from an analysis of variance are reported. The reader is referred to the article by Das and Kirby (1978) for a rebuttal to the other theoretical concerns Humphreys raises.

TABLE 1
VARIMAX FACTOR LOADINGS FOR THE BATTERY OF TESTS
($N = 165$)

Variable	Successive	Simultaneous	Sustained Attention	h^2
Matrix A	16 ^a	84	07	73
Matrix B	05	66	03	44
Figure Copying	30	59	09	45
Hidden Figures	20	53	24	38
Digit Span	78	19	24	71
Letter Span	75	15	23	64
Word String	60	30	28	53
Digit Attention	21	14	75	63
Letter Attention	35	08	74	68
% Variance	20.7	21.6	15.3	57.6

^aRounded to two places and decimals omitted.

Results

The multivariate main effects for the simultaneous [$F(4,138)=6.1$, $p<.001$] and successive [$F(4,138)=6.4$, $p<.001$] factors were significant with all corresponding univariate main effects significant also. The high simultaneous and high successive groups did better on all the achievement variables than the corresponding low simultaneous and low successive group.

The multivariate main effect for the sustained attention factor was significant [$F(4,138)=2.9$, $p<.05$]; however, only spelling and reading produced significant univariate main effects. The high sustained attention group performed significantly better on these achievement variables.

A significant three-way multivariate interaction was obtained [$F(4,138)=2.8$, $p<.05$]; however, the univariate interaction was significant only for spelling and reading. These interactions are illustrated in Figures 1 and 2. In order to understand the three-way interactions, analyses of simple effects were carried out at each level of the three factors. Two significant multivariate two-way interactions were obtained.

The first one of these was between the successive and sustained attention factors for the high simultaneous group. This suggests that the students in the

high simultaneous category performed differentially on the achievement variables dependent upon the category of their successive and sustained attention factors. For this particular significant simple effect, only the spelling variable produced a reliable result [$F(1,70)=5.67, p<.05$] in the univariate analysis. The second significant multivariate interaction was observed between simultaneous and successive factors for the high attention group [$F(4,66)=3.10, p<.05$]. This suggests that the students in the high attention category performed differentially on the achievement variables dependent upon the category of their successive and simultaneous factors. However, the corresponding univariate results were significant only for the reading variable [$F(1,69)=3.89, p<.06$].

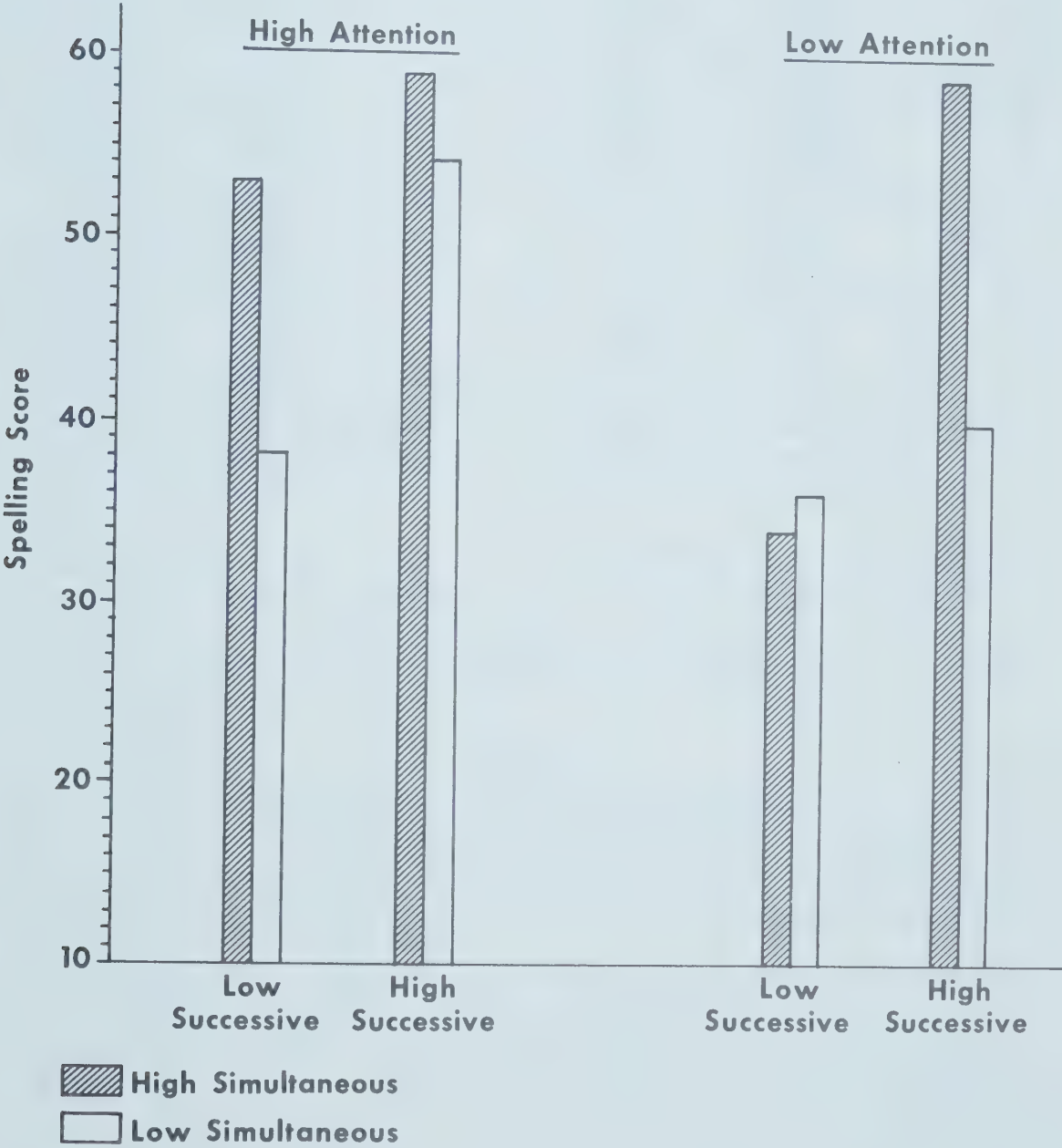


Figure 1. Three-way interaction for the spelling variable.

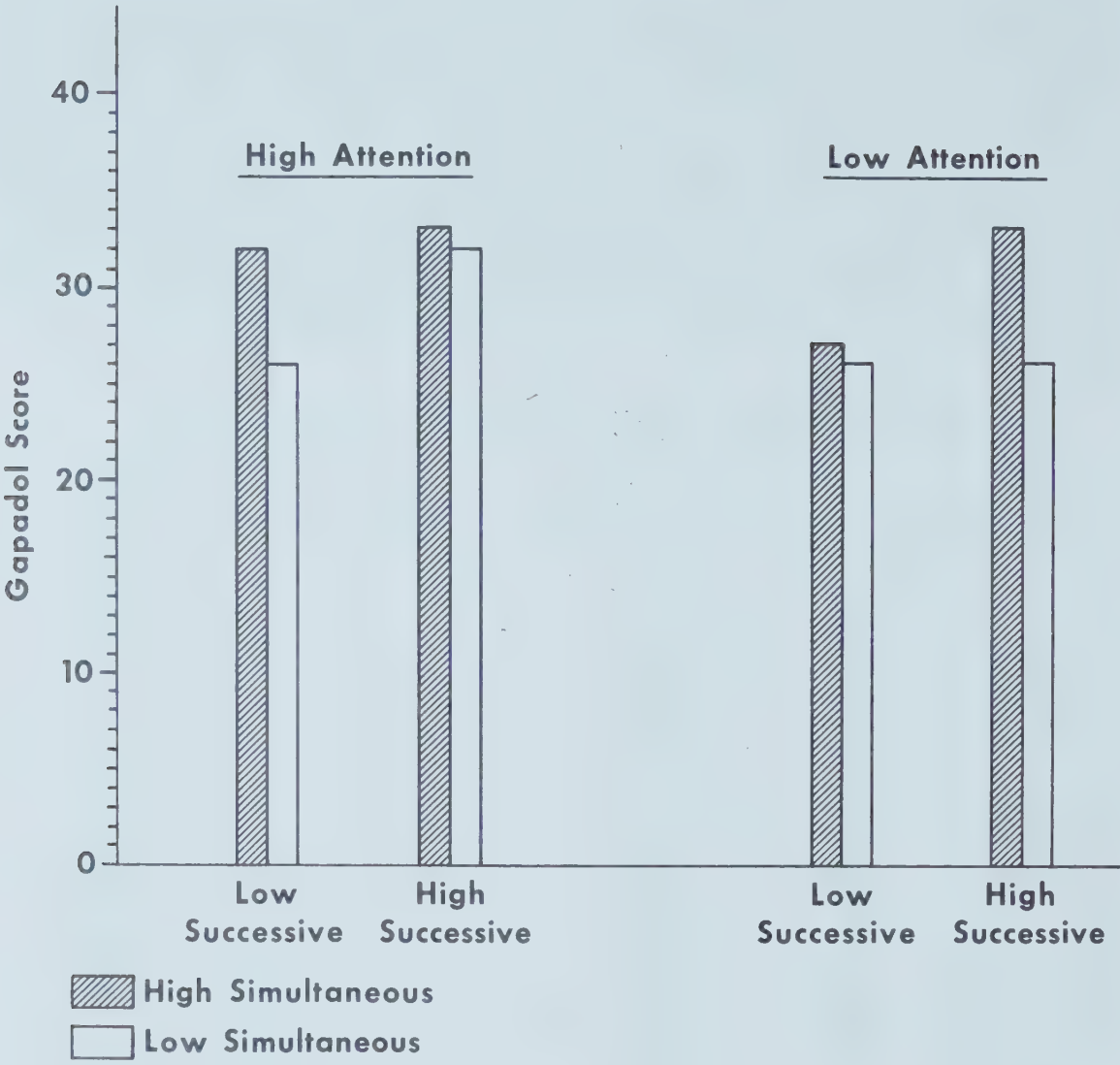


Figure 2. Three-way interaction for the reading variable.

TABLE 2
CORRELATIONS BETWEEN FACTOR SCORES
AND FOUR ACHIEVEMENT VARIABLES

	Varimax Factor		
	Successive	Simultaneous	Sustained Attention
Spelling	.39*	.27*	.35*
Math 1	.31*	.40*	.10
Math 2	.22*	.36*	.07
Reading	.27*	.30*	.40*

* $p \leq .05$

The three-way interactions on achievement variables, more specifically reading and spelling, are further illustrated by the intercorrelations of factor scores and achievement variables given in Table 2. It can be seen that three-way interactions emerged only on those achievement variables, reading and spelling, which had significant correlations with the three factors.

Discussion

In both measures of mathematics, it would appear that those students who are high in both successive and simultaneous processing obtain highest scores and those who are low in both are the lowest, irrespective of whether they have a high or low measure of sustained attention. Similarly, irrespective of whether the measure for sustained attention is high or low, those students who are high in one mode of processing and low in the other score in between the two extreme groups. These results, using mathematics as a dependent variable, are similar to the results obtained by Kirby and Das (1977) using reading as a dependent variable. However, in the present study, the introduction of a measure of sustained attention significantly influenced the outcomes in reading and spelling.

It would appear that if students are high in both the simultaneous and successive categories, and if this is coupled with a high degree of sustained attention, then students obtain high scores in reading. However, if students are low in one of the successive or simultaneous categories, then whether they score high or low in reading depends upon whether they score high or low on the sustained attention factor. Individual differences in reading are dependent upon many factors. McClelland and Jackson (1978) summarize these factors and point out the importance of the general speed and efficiency of processing visual information as a required prerequisite for good reading. It is not surprising that in the present study a measure of sustained attention plays an interactive role in reading.

Similarly, the results suggest that if students are high in both sustained attention and successive processing, coupled with a high degree of simultaneous processing, then they obtain high scores in spelling. Similar to the results in reading, if students are low in one of the sustained attention or successive categories, then whether they score high or low in spelling depends upon whether they score high or low on the simultaneous factor.

One possible interpretation of these results would be that a conjoint high performance on two of the three factors is compensating for the low performance on any one of these. This compensation is probably a function of the programming unit. That is to say the programming unit may have developed differential ways of dealing with the inefficiency through the more proficient integration of the two efficient units.

The question could be asked why this is so for reading and spelling and not for mathematics. This is where the task demands have to be taken into account. Because arithmetic may be more dependent upon observing relationships in a more global way, then it would appear that sustained attention is not a determiner for success. The important determiner is the demand of the task itself. In spelling and reading, which are partly dependent upon preceding and subsequent cues, attention to detail is necessary and sustained attention plays a more important role.

Not only, then, is high achievement dependent upon the correct choice of the functioning units necessary for a specific task and the integration of these, but also dependent upon the best orchestration, which includes compensatory activities, of the units an individual has available for a particular task. These orchestrational activities that must originate in the programming unit may be the key to optimal success in dealing with cognitive tasks.

Notes

1. Paper presented at the American Educational Research Association Conference. Boston, April 1980.

References

- Ashman, F., & Das, J. P. Relation between planning and simultaneous successive processing. *Perceptual and Motor Skills*, 1980, 51, 371-382.
- Biggs, J. B. Genetics and education: An alternative to Jensenism. *Educational Researcher*, 1978, 7(4), 11-17.
- Cronbach, L. J. How can instruction be adapted to individual differences? In R. Gagne (Ed.), *Learning and individual differences*. Columbus: Merrill, 1967.
- Das, J. P. Structure of cognitive abilities: Evidence for simultaneous and successive processing. *Journal of Educational Psychology*, 1973, 65, 103-108.
- Das, J. P., & Kirby, J. R. The case of the wrong exemplar: A reply to Humphreys. *Journal of Educational Psychology*, 1978, 70, 877-879.
- Das, J. P., Kirby, J., & Jarman, R. F. Simultaneous and successive synthesis: An alternative model for cognitive abilities. *Psychological Bulletin*, 1975, 82, 87-103.
- Das, J. P., Manos, J., & Kanunga, R. N. Performance of Canadian Native, Black and White children on some cognitive and personality tasks. *Alberta Journal of Educational Research*, 1975, 21, 183-195.
- Dykman, R. A., Ackerman, P. T., Clements, S. D., & Peters, J. E. Specific learning disabilities: An attentional deficit syndrome. In H. Myklebust (Ed.), *Progress in learning disabilities*. Vol. 2. New York: Grune & Stratton, 1971.
- Fitzgerald, D. *A matrix text for measuring simultaneous processing*. Division of Educational Research Services: University of Alberta, 1971.
- French, J. W., Ekstrom, R. B., & Price, L. A. *Kit of reference tests for cognitive factors*. N.J.: Educational Testing Services, 1963.
- Humphreys, L. G. Doing research the hard way: Substituting Analysis of Variance for a problem in correlational analysis. *Journal of Educational Psychology*, 1978, 70, 873-876.
- Hunt, D. Intentional-Incidental learning and simultaneous and successive processing. *Canadian Journal of Behavioral Science*, 1980, 12, 373-383.
- Hunt, D., Randhawa, B. S., & Fitzgerald, D. *Verbal and pictorial cues, and verbal individual differences*. Paper presented at Canadian Educational Research Association Conference, Quebec, 1975.
- Ilg, F. L., & Ames, L. B. *School readiness: Behavior tests used at the Gesell Institute*. N. Y.: Harper and Row, 1964.
- Kirby, J. R., & Das, J. P. Reading achievement, I.Q., and simultaneous-successive processing. *Journal of Educational Psychology*, 1977, 69, 564-576.
- Krywaniuk, L. W., & Das, J. P. Cognitive strategies in native children: Analysis and intervention. *Alberta Journal of Educational Research*, 1976, 22, 271-280.
- Leasak, J., Hunt, D., & Randhawa, B. S. Cognitive processing: Intervention and achievement. *Alberta Journal of Educational Research*, 1982, 28, 257-266.

- Lewis, M. & Baldine, N. Attentional processes and individual differences. In G. A. Hale, & M. Lewis (Eds.), *Attention and cognitive development*. New York: Plenum Press, 1979.
- Luria, A. R. *Human brain and psychological processes*. N.Y.: Harper and Row, 1966.
- Luria, A. R. *The working brain*. London: Penguin, 1973.
- Mackworth, J. A. *Vigilance and habituation*. London: Penguin Press, 1970.
- McClelland, J. L., & Jackson, M. D. Studying individual differences in reading. In A. M. Lesgold, J. W. Pellegrino, S. D. Fokkema & R. Glaser (Eds.), *Cognitive psychology and instruction*. New York: Plenum Press, 1978.
- McDonald, R. P. A simple comprehensive model for the analysis of covariance structures. *The British Journal of Mathematical and Statistical Psychology*, 1978, 31, 59-72.
- McDonald, R. P., & Leong, K. S. COSA: A fortran programme for confirmatory factor analysis. Ontario Institute for Studies in Education, Toronto, 1976.
- McLeod, J., & Anderson, J. An approach to the assessment of reading ability through information translation. *Journal of Reading Behavior*, 1970, 2, 116-143.
- Merrill, D. M., Kowallis, T., & Wilson, B. G. Instructional design in transition. In F. H. Farley & N. J. Gordon, *Psychology and education: The state of the union*. Berkeley: McKutchan, 1981.
- Messick, S. Multivariate models of cognition and personality: The need for both process and structure in psychological theory and measurement. In J. Royce (Ed.), *Contributions of multivariate analysis of theoretical psychology*. New York: Academic Press, 1973.
- New South Wales primary evaluation programme. Australian Council for Educational Research, Victoria, 1971.
- Pask, G., & Scott, B. C. E. Learning strategies and individual competence. *International Journal of Man-Machine Studies*, 1972, 4, 217-273.
- Rothkopf, E. Z. The concept of mathemagenic activities. *Review of Educational Research*, 1970, 40, 325-336.

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Some Data and Reflections Upon the Quality of the Learning Process as Experienced by Third Year B.Ed. Generalist Students at the University of Alberta

A twenty-item Likert-type questionnaire was administered to 180 students in the third year B.Ed. elementary generalist program at the University of Alberta in order to assess students' perceptions of their experience within the program. The practicum component was experienced positively, but students experienced some stress in handling the organization of the generalist program.

In response to public and professional criticism, the Faculty of Education at the University of Alberta has instituted extensive revisions in its Bachelor of Education (B.Ed.) program for future teachers. The center piece of the changes is more practicum experience along with a highly structured configuration of courses and programs. The new programs with some exceptions (Vocational and Special Education) have resulted in a course concentration in the curriculum and instruction (CI) departments of the Faculty. Other departments, such as Educational Psychology, Educational Foundations, and Educational Administration tend to have less classroom contact with students as a result of the B.Ed. revisions. Students from the Faculty of Education tend to have less contact within and without the Faculty with other students and courses than previously as a result of the tight scheduling and program concentration.

The first term began on September 14, 1981, for B.Ed. generalist students with a CI "module" comprising four interrelated CI courses which

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continued until the fifth week (October 16, 1981). One grade was given for a student's performance based upon the mean of the four courses comprising the module. Phase II practicum began October 19, 1981, and continued for four weeks until November 13, 1981. The beginning of the last four weeks of the year (November 16 - December 11, 1981) saw the resumption of the CI module and the simultaneous beginning of courses in Educational Administration, Educational Foundations, and Educational Psychology. The CI module ended December 11, 1981 so there was no study break for final examinations in the module. Some students claim to have spent time on course assignments over the Christmas holiday for the three above courses in Administration, Foundations, and Psychology which resumed on January 11, 1982 and ended on February 22, 1982 (including final examinations). Practicum (Phase III) resumed on February 22, 1982 and continued until April 23, 1982.

As can be seen from above, the elevation of practicum experience to a place of emphasis has been accompanied by some changes in course scheduling practices within the Faculty. Courses run for 4, 6, 10, and 13 weeks, and span Christmas vacation by starting in the Fall and ending in the Spring. The concern for the effects of such scheduling upon the teaching-learning process led to the present research.

The present study arose in response to concerns from a number of students in the class, expressed to the first author, about the revised B.Ed. elementary generalist program. As instructor and student, the present authors determined to assess some of the ways in which students, within the Elementary strand of the revised B.Ed. program, were experiencing the effects of the above changes and whether the concerns of the above students were shared by their classmates. The point of the present study was not to compare the third year B.Ed. elementary generalist program with preceding programs but to explore the experience of students within the present program.

Method

Subjects

The subjects were enrolled in an Educational Psychology course in learning. All students in the third year B.Ed. elementary generalist program were enrolled in the class from which the present sample was drawn. There were 250 students in the class, 180 were present on the day the data were collected.

Procedure

Students entering the program had completed an observational practicum in their first year (ED CI 251) and one participational practicum (ED CI 310) of four weeks at the beginning of the third year. Students had completed one of two complementary ED CI modules of four subjects (nine credits). The remaining module was to be completed during the third year. Modules included either Mathematics, Science, Art, and Movement or Reading, Language Arts, Music, and Social Studies. At the time the data were collected, students had just completed their second module and were about to enter the second phase of their third year practicum of four weeks.

The data were collected at this time before attendance declined as it often does as exams approach and students are preoccupied with exam preparation. Data collection was delayed in order to obtain the largest sample possible. Also,

data collection during the course was expected to tap the extant lived-experience of the students rather than their post hoc recollections.

A twenty-item Likert-type questionnaire (see Table 1) was administered to all students in the seventh week of a ten-week course which started November 12, 1981. Students were given the following instructions: Below you will find a number of statements relating to the third year of the B.Ed. generalist program. Please indicate on the answer sheet your degree of agreement or disagreement. The descriptors on the five-point scale were: strongly disagree, moderately disagree, neither agree nor disagree, moderately agree, strongly agree. Students responded anonymously on optical scoring sheets which were subsequently analyzed.

Previously, students had been asked to write a list of their concerns about the new B.Ed. program. These were collected by the second author and content analyzed to provide the topics for exploration in the present study. Items were developed directly from the student concerns. Some of the items were arranged to control a response set. If a respondent answered affirmatively to all items, nine of them would be critical of the program while eleven items would be supportive. The item presentation was randomly ordered.

Results and Discussion

Table 1 shows the 20-item questionnaire and the percentage of respondents choosing each option for each item. Inspection of Table 1 shows that for most items the distribution of responses is markedly skewed with standard deviations ranging from 1.0 to 1.3. Skewness and relatively low variability characterize the responses to most items. Consequently for the sake of convenience, the "moderately" and "strongly" categories are combined in the data presentation. Particular item distributions are articulated in the course of the data presentation. The total percentage of responses for the "moderately" and "strongly" categories of agreement/disagreement are presented together with the breakdown of the percentages of responses in the respective categories. The composite sub-percentages are shown from left to right as they appear in Table 1. If the item involves agreement the category order is moderately, strongly. If the item involves disagreement the category order is strongly, moderately.

The vast majority of students (88%-11,77) perceived their practicum as a positive experience (item 11). Consequently, as might be expected, 77% (26,51) thought their cooperating teacher taught them a lot about teaching (item 12). A high percentage (82%-35,47) thought four weeks with one teacher was desirable (item 14). Many students (72%-22,50) also wanted additional practicum in the fourth year of their program (item 15). The modal response for the four items concerned with practicum was in the "strongly" category, suggesting a fairly clear indication of students' positive perceptions of their practicum experience.

The rectilinear distributions of responses to items 13 and 17 indicate that students have varied opinions about the adequacy of their preparation for student teaching. The specific reasons for their ambivalence warrant further investigation.

The policy of averaging marks in the CI module caused concern for 52% (19,33) of the students (item 9). Eighty-one per cent (27,54) of the students believed that averaging marks did not give them feedback about specific strengths and weaknesses in individual subject areas (item 10). The overall pattern of responses in these two items suggests that evaluation and feedback within the "module" was a greater concern for the students than the procedure of giving students an overall average mark.

TABLE I
RESPONSES TO THIRD YEAR GENERALIST B.ED. PROGRAM QUESTIONNAIRE

	Score		Response Category Percentage					
	Mean	Std.	NR	1	2	3	4	5
1. Splitting the CI module into two segments for Phase II of the practicum increased stress due to delayed performance assessment.	3.8	1.3	0	10	7	14	31	37
2. Splitting the CI module into two segments for Phase II of the practicum disrupted the continuity of learning of CI methods.	3.8	1.3	0	8	10	12	29	41
3. The four-week break between practicum segments necessitated additional review and stress.	3.7	1.2	0	8	7	19	38	28
4. Attempting to cope simultaneously with review for CI module courses and student teaching and preparation was reasonable and non-stressful.	2.3	1.2	1	32	29	18	15	6
5. Preparing for final exams in the CI module made it very difficult to attend to offerings in concurrently overlapping courses in Psychology, Administration, and Foundations.	4.4	1.1	1	6	5	2	19	68
6. The interruption of the instruction of the CI courses with the practicum had no disruptive effect on the learning process.	2.4	1.2	0	28	36	14	17	6
7. I would prefer to complete courses before being required to begin my student teaching or other course work.	4.3	1.1	0	4	4	10	20	62
8. Writing final exams in the CI module while beginning new course work was stressful.	4.4	1.0	0	4	3	6	22	65
9. The averaging of the marks in the CI module caused no concern for this student.	2.6	1.5	0	33	19	14	17	17
10. The averaging of the marks in the CI module did not show my strengths and weaknesses in individual subject areas.	4.2	1.2	0	7	4	8	27	54
11. I believe that the practicum experience was a positive learning experience.	4.5	1.1	0	6	2	4	11	77
12. My cooperating teacher for the four-week practicum taught me a lot about teaching.	4.0	1.3	0	10	6	7	26	51
13. I felt well-prepared for the student teaching phase of this degree.	2.9	1.3	0	18	23	22	24	12
14. The four-week practicum with one cooperating teacher was desirable.	4.2	1.0	0	3	6	9	35	47
15. I would like to have the opportunity to experience a practicum in the fourth year of the generalist program.	4.1	1.2	1	6	3	19	22	50
16. The organization of the third year of the generalist program has provided a meaningful learning environment.	2.1	1.1	0	38	27	22	9	3
17. I feel that I am well prepared to teach elementary school children in each of the subject reas.	2.6	1.2	1	23	31	17	23	6
18. I believe that the generalist program is providing me with a well rounded education.	2.9	1.2	0	17	20	28	29	6
19. I perceive an inconsistency between desirable educational theory and the organization of the generalist B.Ed. program.	3.9	1.0	0	2	7	24	36	31
20. The meaningful fulfilment of course requirements requires more time than is presently available.	3.9	1.1	0	3	8	18	31	39

Note. The failure of some item response categories to total 100% is a function of rounding category responses.

Responses to five items (1, 3, 4, 7, 8) suggests the extent of stress experienced by students as a function of the revised organization of the B.Ed. elementary generalist program. The splitting of the CI module was experienced as stressful by 68% (31,37) of students due to delayed performance assessment. A significant majority (66%-38,28) also found the four week break between practicum segments to be stressful. Students (61%-39,22) also found it difficult to cope simultaneously with practicum and academic requirements. The vast majority of students (82%-20,62) preferred to complete academic course requirements before beginning practicum. Most students (87%-22,65) found beginning new courses while writing

exams in others to be stressful. The modal response for the five items dealing with students' experience of the organizational changes of the new program was in the "strongly" category on four items and in the "moderately" category on the other item. Consequently, these data present a fairly strong statement of part on the students' experience.

The final group of items (2, 5, 6, 16, 18, 19, 20) deal with the nature of the learning process as experienced by elementary generalist students. Responses to items 2, 5 and 6 show that students perceived the organization of the third year elementary program to be a disruptive influence upon learning. The splitting of the CI module (item 2) was perceived as inhibiting the continuity of learning by 70% (29,41) of the students. Writing finals for CI module while simultaneously beginning new courses made it very difficult to attend to the new courses according to 87% (19,68) of the students (item 5). Some students commented that they didn't open a book for the new courses until the module exams were over. A smaller majority (64% -36,28) of students found the interspersing of the CI module with practicum to hamper their learning (item 6). In general, 65% (27,38) of the students (item 16) did not find the organization of the third year generalist programs to provide a meaningful learning environment. Students were equivocal as to whether the same program provided them with a well rounded education (item 18). A majority of students (67% -36,31) perceived an inconsistency between desirable educational theory and the organization of the B.Ed. elementary generalist program (item 19), while 70% (31,39) of them thought more time was needed to fulfill course requirements if optimum learning was to occur (item 20).

The modal response for the seven items dealing with students' perceptions of the quality of the learning process was in the "strongly" category on four items and the "moderately" category on two items. The responses to item 18 were distributed almost rectilinearly. These data present evidence of some students' dissatisfaction with the quality of the learning process they experienced. The wording of the items reflects the student concerns from which they were developed and may have tended to facilitate criticism rather than to encourage an impartial evaluation. Nevertheless, the data do reflect student opinions.

These data indicate some students' thoughts and feelings on a number of aspects of the B.Ed. elementary generalist program: The practicum is perceived and experienced positively. Students are ambivalent about the adequacy of their preparation to teach, as might be expected when they are engaging in a new activity. Students do not like the policy of averaging marks in the CI module. Students experience the current organization of the program as stressful. Students do not like overlapping courses and/or practicum. Students believe that the current organization of the program inhibits learning. Students perceive a discrepancy between pedagogy as professed and practised within the B.Ed. elementary generalist program.

Much of the difficulty experienced by students reflected in the above data is the result of logistical problems. In the course taught by the first author, from which the data were collected, rooms were assigned for 15 seminars in addition to lectures times for the first four weeks of the course before Christmas recess. After the Christmas break, all seminar and lecture rooms had to be changed because of the previously mentioned asynchrony of course scheduling. This added to the stress caused by usual scheduling problems such as nonexistent rooms and seminars scheduled in wrong locations. The instructor was also asked by the Elementary Education department not to schedule any examinations or

assignments during the first four weeks of the course due to students completing exams in the overlapping CI module. In effect, the course became a six-rather than a ten-week course in terms of assignments and exams. The midterm exam was cancelled causing more weight to be placed upon the final exam. Planning for the course had to be drastically revised.

The present data are relevant to the recent Report of the Committee to Evaluate the Extended Practicum Program at Alberta Universities (1981). The report stresses the importance of the integration of theory and practice within the whole teacher training process (e.g., pp. 9, 36, 39). The report also stresses the need for structure to ensure sound general education of teachers. However, the present data suggest that the structure inherent in the B.Ed. elementary generalist elementary program or its current operation may not facilitate the integration of theory and practice nor produce student perceptions of a good general educational experience. The present structure seems more reminiscent of the types of programs criticized in the report (p. 26). Further examination of the new B.Ed. elementary generalist program is needed in order to check the validity of the implications of the present data.

The organization of the B.Ed. elementary generalist program is so compartmentalized that it is difficult to integrate theory and practice. The report (p. 28) makes the point that "the duration of the practicum is of secondary importance to the quality of the linkages between students' experiences in the classroom and the content and methodology of their professional courses." The present data suggest that this linkage may be inhibited by compartmentalization in the B.Ed. elementary generalist program. The compartmentalization in the B.Ed. elementary generalist program has also made it more difficult to fulfill the suggestion in the report (p. 25) that close ties be maintained between university departments of education and other academic and professional departments within the university. The scheduling of the courses within the elementary generalist program is quite different to the course scheduling of other faculties.

Perhaps the central finding of this study is the considerable stress experienced by students. The data suggest that the existing organization of the B.Ed. elementary generalist program may be the principal cause of stress. The following suggestions may lead to a marked reduction in stress and a consequent improvement in students' perceptions of their experiences in the third year of the B.Ed. elementary generalist program: Reduce the amount of compartmentalization in favour of increased continuity by (a) adopting a thirteen week continuous practicum, (b) eliminating split modules, (c) eliminating overlapping courses and practica, (d) eliminating overlapping courses, and (e) standardizing the length of courses to thirteen weeks so that they are in synchrony with most other university courses.

Another set of alternatives to the above recommendations involves attempting to modify the existing organization in the following ways: (1) Try to reduce anxiety over impending practicum experience with increased attention to preparation for this experience. (2) Try to improve the integration of the university based instruction and the practica in order to facilitate continuity of experience. However, with over 250 students in the program, this may be very difficult. (3) Increase the emphasis upon integration within the module and increase the amount of feedback about student performance so that it is continuous and specific rather than terminal and general.

A third possibility is to turn the Faculty of Education into an autonomous school (e.g., Teachers' College or Normal School) as a way of eliminating the problem of integrating courses and programs with the rest of the University.

The present authors favor the adoption of the first set of recommendations because they appear to be the most likely way of reducing student stress and improving the quality of the learning experience of third year B.Ed. elementary generalist students by facilitating integration of the program into the university as a whole.

There are also other possible combinations of the recommendations made here. For example, regardless of whether major organizational changes are made or not, the program can doubtlessly improve with greater attention to the integration of the module components. However, the present authors believe that the complex nature of the present organization, given existing numbers of students and limited faculty resources, is the major cause of the difficulties reported by students in these data. This intrinsic organizational problem of the program is not likely to be solved by fine tuning in subsequent years of the program's operation. Short-term adjustments such as more attention to integration of university and school based experiences may improve the program but not eliminate the inhibiting effect upon learning of the compartmentalization and overlapping reported in these data. We also believe that, regardless of how faculty or interested outsiders perceive the third year B.Ed. elementary generalist program, the value of the program is largely dependent upon the way it is experienced by the students who live through it.

The strong interest in a practicum experience in the fourth year of the program (item 15) is understandable in the light of the overwhelmingly positive responses of students to their third year practicum experience. The question of a fourth year practicum raises issues about the relative importance of university based and classroom based teacher training or more specifically, the relation of conceptual knowledge of subject matter content and teaching methods to classroom application. The appropriate degree of emphasis upon either of these two sides of teacher training and their meaningful integration warrants continuing consideration. Perhaps in the past, practicum experience has been understated; however, caution may be advisable in avoiding an overreaction resulting in the production of skilled teacher-technicians who are short on in-depth subject matter knowledge and higher order conceptual abilities. The degree of student ambivalence about whether they are receiving a well rounded education (item 18) supports this concern.

The data of this study are derived from students' perceptions of their lived experience within the third year of the B.Ed. elementary generalist program. The study focuses specifically upon this perspective. Whether the perceptions of instructors and teachers involved in the program are different from those of students remains an empirical question. Whether the students' perceptions are justified or not does not negate the reality of their having those perceptions. Sometimes there is a gap between the rationale and the projected understanding of educational planners and those who participate in the implementation of the plans. This study is part of the process of identifying the perceptions of major participants (students) in order to promote greater understanding. The personal involvement of the authors in the situation from which the data are drawn also needs to be borne in mind. The present study was not an attempt to evaluate the

B.Ed. elementary generalist program impartially but an attempt to assess the extent of student concerns which were spontaneously presented by some students to the first author. The items in the questionnaire reflect the ways in which, at least, some students were experiencing the program. Those data appear to suggest that the student perceptions which led to the study were shared by a considerable number of other students.

The present data also suggest the need to explore in more detail students' reservations about their preparation for student teaching in the third year and their reservations about their preparation in various subject areas. Further research may disclose whether student reservations about the elementary B.Ed. program are unique or comparable to reservations about other programs.

The most disturbing aspect of the revised third year B.Ed. elementary generalist program for the present authors is the doubtlessly unintended drift towards an apparent assembly line approach to teacher training reflected in the course organization. The experience of students reflected in the above data suggests a possible lack of sensitivity to the lived-experience of the student within the planning and implementation of the program. Learning is obviously more than a matter of interfacing students and resources. The learning process in a course requires considerably more time than the number of contact class hours in order to read, reflect, write, and engage in the ancillary classroom activities that are a vital part of meaningful learning. We believe that the present data warrant serious reconsideration of the organization of the third year B.Ed. elementary generalist program with a view to reducing student stress and facilitating the integration and continuity of the learning process for teacher preparation.

References

Theory to practice. *Report of the Committee to Evaluate the Extended Practicum Program at Alberta Universities*, December, 1981.

PERSPECTIVES

Education and Women's Work: Some New Research Directions

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The unequal position of women in the labour force is a cause for political concern and academic interest. We know that women earn about 60% of what men earn. Women are concentrated in a few occupations. One third of them are in clerical jobs; the rest are mostly in sales and service jobs and in teaching and nursing. Whatever they work at, women are more likely than men to be at the bottom end of the hierarchy of responsibility and power.

Educators, policy-makers, and sociologists have long investigated the ways in which schools help to produce the problems we see in the workplace. In this paper I will look at how we can understand the relation between school and work for women. I will argue that the research that has been done on this question has been very one sided, concentrating on documenting the differences men and women bring into the workplace — differences which are shaped by the schools. In this kind of research there is at least the implicit assumption that institutional processes are open and competitive, that people are able to choose among alternative options at school and work, and that employers accurately identify and equitably reward individual characteristics. But the amount of sexual segregation at work is much greater than the differences between males and females in achievement and personality. Our assumptions about how competition and choice are set up need to be carefully examined. We need to pay more attention to the ways the school and the workplace appraise, develop, and channel the skills and

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abilities of men and women instead of assuming a meritocratic process. We need to look at how these processes operate in different ways in different educational settings and segments of the labour market and not assume that the same processes occur everywhere.

Research on individual differences

The two research traditions which have been most important in establishing educational achievement as one of the principal determinants of an individual's position in the labour force are occupational status attainment research and human capital theory. Both concentrate on understanding how differences among individuals produce differences in their labour market experiences. Both then suggest that changes in individuals, particularly changes in their schooling, could change their experience in the labour market. Both traditions lead easily to the assumption that the problem for women lies in the schooling they have or do not have rather than in the structure of opportunity that they confront.

Occupational attainment research is a research technique rather than a fully developed theoretical model, although the technique implicitly makes various assumptions based in structural-functional theory (Horan, 1978). Researchers use various individual attributes such as parents' socioeconomic status, educational achievement, IQ, attitude measures, and the like to predict an individual's occupational achievement. Such attributes are measured on a unidimensional scale from high to low. Using these techniques, educational achievement has been found to be an important predictor of occupational achievement even though the amount of variance accounted for in any of the models is generally low (Jencks, 1972, 1979).

The status attainment model was developed for the most part on male populations. Blau & Duncan (1967), in their extremely influential book on occupational attainment in the U.S., dealt only with men, stating that

men's careers occupy a dominant place in their lives today. . . a knowledge of the occupational structure and of the conditions that govern men's chances of achieving economic success by moving up in the occupational hierarchy is . . . essential for understanding modern society. (pp. 7-8)

Women are considered, but only as wives who might influence their husbands' careers. Women are not included in their own right because their careers were not considered important and/or because they did not easily fit the model. How does one determine the status of housewife and how does one deal with the time she may be out of the labour force? In the traditional model it is easier to omit them from consideration.

Human capital theory leads one to predict that an individual's educational achievement will be rewarded at work by an increase in income because more educated workers are more productive workers. Becker's (1964) human capital theory is not explicitly limited to men, as Blau and Duncan's work is. He discusses investment in "people" and "human" capital. However, it is clear that his data and theory apply more precisely to men than to women. In a section on women, he notes that income differences between well educated and less well educated women are smaller than these income differences are for men. This suggests human capital theory does not work as well for women as for men, employers are not prepared to pay them as much for their education. He deals with this difficulty first by suggesting that women might be experiencing an equal rate of

return to their investment in education, in any case, because the cost of their education is less if one takes into account forfeited income while in school. He finds that even this somewhat circular reasoning fails to make the lower rate of return for women disappear. He then suggests that a woman's husband's income should be treated as an income return to her education since she was able to marry a wealthier man by continuing her education. This helps, but "even when the gain from a more lucrative marriage is included, the money rate of return from college seems less for women" (p. 102).

Both the basic Blau and Duncan model of status attainment and Becker's notions of education as human capital retain their importance today in academic research and policy discussion. We tend to look at individuals' education in order to account for their position in the labour force. Attempts to include women in the analysis have increased as women's participation in the labour force has risen. But the models which were used to account for men's experience are of limited utility in trying to explain why women remain disadvantaged in the labour force. I suggest this means we need to take a second look at the models. Even when adjustments are made to include some extra variables in the old frameworks, these frameworks remain inadequate, as will be set out below.

(a) Achievement differences

Both status attainment models and human capital theory suggest that staying in school longer and doing well there should increase one's position in the labour force. Use of the model by researchers has led them to attribute the relatively lower status of women in the work force to lower school achievement.

The idea that women do relatively poorly in school is widespread. Byrne (1978) in her book on women in education refers to women as an "underachieving group" along with the working classes and rural children (p. 15). Finn, Reis and Dulberg (1980) state, "No matter how attainment is conceived, the one-sidedness of the issue is clear." In Canada, the Royal Commission report on the status of women (1970) emphasized that women were underrepresented in post secondary education, especially in graduate and professional programmes. A recent Economic Council of Canada discussion paper states that "Recent studies indicate that being a woman sharply reduces the probability of undertaking advanced studies, regardless of area of study. In fact, the higher the qualification the lower the proportion of women" (Boulet & Lavallee, 1981). Synge (1977) emphasizes the "relatively recent access of women to secondary and post-secondary education" (p. 298).

Much less attention has been paid to the evidence that girls do better than boys in public schools and that, on the average, women in the labour force are better educated than boys are. Girls read better, at least in North America, and reading is the basis for most school tasks. Boys are more likely to be in special classes for slow learners and to have learning deficits. Girls also progress faster than boys through school and are less likely to be above the modal age for their grade. Girls are more likely to stay in school until they graduate from high school (Perspective Canada, 1974; Maccoby & Jacklin, 1974).

Statistics on the educational attainment of the population show that women are overrepresented at the middle levels, which account for the largest percentage of the population, and are underrepresented at the low end. Women continue to be overrepresented among those with diplomas or certificates at the postsecondary

level even though they are underrepresented among those with university degrees. The educational levels of women in the labour force are higher still, relative to men's. Women in the labour force are less likely to have only elementary school education, and are more likely to have both high school and postsecondary education (Picot, 1980).

Women's overrepresentation in the high school has been a fact since records have been kept for public high schools. Boys dropped out of school earlier, so we find that in the U.S., girls were 58% of all public high school students in 1890, 57% in 1900, 56% in 1910, and 56% in 1920. The predominance of females is even more striking for high school graduations from 1890-1920 where over 60% were girls (Poss, 1981). In British Columbia, girls accounted for 63% of high school enrollments in 1900, 57% in 1920, 54% in 1940. (B.C. Public School Reports, 1900-1940). Robb and Spencer (1976) show that not until 1950 did the school attendance rates of 15-19 year old Canadian boys catch up to the girls'.

Women's participation in university education has increased rapidly. "In 1960-61, only one of every four bachelor's degrees was awarded to a woman. By 1980, women were earning one out of every two, and it is anticipated that in this decade female bachelor degree recipients will outnumber men by an increasing margin" (Zur-Muehlen, 1982, p. 5). The Anisef, Paasche and Turritin (1980) study shows that girls in Ontario are more likely to go to community college than boys and that there is little difference in those going to university.

Women in the labour force have more education than men yet they are paid less for the work they do. Women earn far less than men for every year of education they complete, and the ratio of male to female earnings has not improved over time. Statistics Canada (1979) shows that women with a university degree earned \$11,363.00 on the average in 1977 while men with a university degree earned \$20,337.00. Women with some high school education earned \$5,766.00 while men with equivalent education earned \$12,085.00. Women with university degrees were earning, on the average less than men with only some high school education. The difference is true for the first year on the job as well as later years, so differences in performance and experience cannot account for the discrepancy.

Feathermen and Hauser (1976), using a regression model, found that the earnings benefit of an additional year of schooling was \$279 for males and \$81 for females in 1962. It increased to \$406 for males and \$180 for females in 1973. Though this constitutes a much larger percentage increase for females, the absolute dollar amount of the difference became larger over that period.

If the status of one's occupation is used as the dependent variable instead of income, the differences in returns are much smaller. The relationship between educational attainment and occupational status is as strong or stronger for women (Goyder & Pineo, 1973; Anisef et al., 1980; Featherman & Hauser, 1976), although there is some disadvantage for women with high educational achievement (Marsden, Harvey & Charner, 1975; Boyd, 1981). Status ratings are strongly influenced by the educational levels of people holding the jobs thus making the prediction of status by education a somewhat circular process. Moreover, using status as a measure of occupational success does not reveal the fact that women are disadvantaged in the workplace (Wolf & Fligstein, 1979). The occupational status distributions of men and women have similar means and standard deviations. Thus status measures are not very useful in telling us about processes that differentiate men's and women's occupational chances.

In sum, women's achievement in school is not, as is usually assumed, substantially lower than men's and cannot account for the lower economic rewards they experience at work. Staying in school has not meant getting ahead for women, at least relative to men. While an individual woman may improve her position relative to other women by staying in school, women as a group have not been able to turn superior educational achievement into superior economic rewards.

(b) Differences in course choice

If achievement itself is not the problem, some have suggested that it is the kind of education women get and the courses they choose that constitute the problem. Although we think of our schools as coeducational, there is an enormous amount of segregation by sex, starting in the secondary school where business education, industrial education, home economics, mathematics, and the physical sciences show substantial differences in course enrollments (Anisef, 1980; Scott, 1981; Gaskell, 1981). At Canadian community colleges, Devereaux and Rechnitzer (1980) show more than twice as many males as females in business and commerce, data processing, engineering, and primary industry programs. Females are equally overrepresented in social welfare, household sciences, general arts, education, nursing, secretarial science, and other medical and dental programmes. At the university in 1978-79, males were more likely to be in engineering (6% F), commerce (30% F), medicine (34% F), dentistry (18% F), architecture (25% F), forestry (21% F), law (34% F), religion (27% F), science (35% F); females were more likely to be in education (74% F), fine and applied arts (65% F), household science (98% F), and nursing (97% F) (Statistics Canada, 1980, p. 25).

The trends over time are for more equal representation of women at the university level, although similar trends cannot be established at the high school and community college. Female enrolment increased substantially over 5 years in every predominantly male faculty. It went up 13% in law, 10% in medicine, 15% in forestry, 10% in architecture and 4% (the lowest increase) in engineering (Statistics Canada, 1980). The organization of community college programs has changed so rapidly in the last 10 years that comparisons over time would be difficult to do reliably. Moreover, enrolment figures from Statistics Canada are not broken down in a way that displays sex segregation easily. In the high school, enrolment data are also hard to come by and show no clear shift to more equal representation by sex (Gaskell, 1981a, 1983).

Course enrolment shapes skills and interests and develops a sense of competence and familiarity with different areas of experience. It influences choices about work and affects the ability of students to get different kinds of work and to get into programmes of further study. Background in mathematics, physics, and computer science is an increasingly critical filter affecting vocational training and job prospects.

However, course choice still leaves a good deal of unexplained variability in the labour market returns to education for men and women. Even when the kind of education women get is taken into account, they do not get income returns to their courses that are equal to men's. Anisef (1980) shows the males graduating from the high school academic program earn \$3,000 more than women graduating from the same program. In commercial courses, the gap is \$2,300 and in technical and vocational courses, \$2,000. The gender gap is least for graduates of the industrial

programs. Young women enrolling in industrial courses make \$1,400 more than the young women graduating from the academic program, and almost \$3,000 more than the young women from the commercial program. Schooling can help a girl, relative to other girls, but it is not effective in overcoming group differences between males and females.

Statistics Canada (1980b) and Devereaux and Rechnitzer (1980) report similar data for community college graduates. In every case, the males graduating from a course make more money than the females graduating from the same course. For two-year diploma graduates, the difference is \$5,000: \$4,000 in general arts and science, about \$3,000 in primary industry, \$3,000 in applied sciences, community services and business management, \$2,000 in trades and crafts, and engineering — and so on. Taking medical and dental services or computer science raised women's salaries most relative to other women's.

The same survey reports income data for university graduates by field of study. The sex differences in earnings ranged from about \$100 in pharmacy and the fine and applied arts to \$1,000 - \$2,000 in education, engineering, history, and law, to \$6,000 in medicine and dentistry. Women in engineering and education earned the highest salaries of any women graduates. A recent U.S. multivariate analysis of income returns to university education showed that taking major field of study into account reduced the gap between male and female income returns "only slightly" (Angle & Weissman, 1981).

If we turn from income to occupation, the returns to taking nontraditional courses also seem to be lower for women. Having taken a "male" course, they are less likely to get a "male" job. There is a good deal of research showing a low relationship between field of training and type of job (Little, 1970; Wilms, 1974; Pincus, 1980). The reasons for a low relationship are varied. An educational credential provides the possibility of work in an area but does not guarantee a position. Other factors such as personal contacts, personality, and discrimination remain important — often more important than education (Granovetter, 1974; Levinson, 1975). The match between the number of graduates in any field and the number of jobs in the field is not perfect. Employers often do not demand a close fit between training and the job, assuming much can be learned on the job as long as the "right sort of person" is hired.

Even women who do enter broad or atypical fields of training tend to get jobs in traditionally female areas. In the community college, women with business diplomas get clerical jobs; men with business diplomas get managerial positions (Devereaux & Rechnitzer, 1980). At university, the type of course a woman selects decreases the likelihood of her doing clerical work, but only in medical and technical areas does it reduce it below 1%. More women than men enter teaching from every field of study at the university, except French. Men who get a teaching certificate are more likely to be employed in higher paying jobs not related to education (Devereaux & Rechnitzer, 1980). The tendency for women to revert to traditional jobs increases as time since graduation increases (Bielby, 1978).

In sum, the differences between the courses men and women select while they are in school can only partially explain differences in their experience in the labour force. Attention to these differences leaves unexplained why programmes that are predominantly female systematically lead to lower paying jobs. It leaves unexplained why women in predominantly male programs do not get jobs that are equal to the jobs their male counterparts get.

A related problem should be pointed out here. Research on sex differences in course enrolments tends to explain the differences in enrolments by looking at differences among individuals choosing the courses. This is the same model I have been examining in relation to the labour market and some comments of a similar nature can be made. Individual differences do not constitute a complete explanation of differences in course enrolments. They constitute a partial explanation, one that avoids examining the structure within which "choices" are made.

The emphasis in course selection research has been on why girls tend to select traditionally female programs. Ability differences have been considered although ability differences are so much smaller than differences in course selection that they can only account for a very small part of the variance (Robb & Spencer, 1976; Kimball, 1981). Differences between males and females in anxiety levels, personality traits, and interests are explored (Parsons, in press; Fox, 1981). The explanations are always partial. As one would expect, all sorts of girls choose, for example, nursing courses or secretarial courses. As Herzog and Bachman (1982) suggest, "young people who plan on similar occupations share few common values" (p. 159). If a pattern emerges in nontraditional areas, it is what Alice Rossi (1965) has called a pioneer, an unusual woman who can take on the difficult job of being in a minority in a male field (Rezler, 1967; Walshok, 1981). In other words, girls going into male fields may need qualities that are different from the qualities required by men in those fields. Researchers cannot assume females and males with the same characteristics will fare equally well. In order to understand this, we need to explore how the situation is different for girls, and how we might make the programs as safe for mediocre girls as they are for mediocre boys. This involves a change from looking at individuals to looking at institutional arrangements.

Course choices are often produced by job choices. Whatever her anxiety about mathematics, a girl who wants to be a nurse will take it if she needs it to get certified (Parsons, in press). Recent research shows very little closing of the gap between males and females in high schools since 1964 with respect to their occupational preferences (Lueptow, 1981; Herzog, 1982). Choices of traditionally female occupations remain sex-typed as do those for skilled blue collar occupations. Females are becoming somewhat more likely to choose male white collar occupations. But as an explanation of course choice, this takes us back to the same dilemma. Job choice can be explained with reference to girls' interests, abilities, and ideas, or with reference to the institutional structures that confront them. Plans are not based only on preferences, but also on what is deemed acceptable and feasible in today's world of work. Thus young women may have already modified their plans in line with what they perceive to be occupational careers open to women (Lueptow, 1981).

(c) Differences in socialization at school

Attempts to rework status attainment models to account for women's experiences have added on variables that had not been considered important for men. As Alexander and Eckland (1974) conclude in their comparison of male and female data, "It is quite clear that the educationally relevant variables examined here. . . do not account for the sex liability in the data. The model must be expanded to include factors not typically included in the study of males. This might involve the addition of marriage and fertility variables, sex role specific

attitudes" (see also Boyd, 1981; Sokoloff, 1980). Research in this tradition then bends the model to account for women's experience, but continues to focus on what it is about women (their attitudes, their marital status, their labour force participation) that produces problems for them in the labour force.

Much of the research on women in schools has explored how schools are agents of sex role socialization through which girls develop attitudes, interests and social behaviors that cause problems for them in the labour market. Whatever theory of socialization one accepts, there is evidence that the process of gender socialization is continued in the school (Richer, 1979). Traditional views of what is appropriate for women are taught through the "hidden" curriculum as well as through the official curriculum. Books and media used in the schools either omit women or portray them in traditionally stereotyped roles (Fisher & Cheyne, 1977). The everyday life of children in schools is permeated with stereotyped ideas about male and female roles (Delamont, 1980). Teachers interact more frequently with boys and allocate tasks according to traditional notions of male and female interests (Russell, 1979; Clarricoates, 1981).

This research has alerted teachers to discriminatory practices and continues to be an important influence in bringing about a more egalitarian school system. It directs our attention to the ideological context in which we learn to think about gender and shows how young women and young men come to think about their future in the labour market in different ways. However, there are several problems in examining only how schools produce traditional sex role beliefs and in relying on sex role socialization to explain adult gender differences.

What girls learn in school is at least more complicated and less consistent than all the emphasis on traditional roles suggests. It could be argued that school is less likely to reward traditional femininity than many homes and workplaces are. More educated women tend to be less traditional in their opinions on gender issues (Gibbins, Ponting & Symons, 1978). Formal school processes are similar for both sexes and teachers tend to be well educated women who have more liberal opinions than most other groups in the society. Little research has been done to look at both the liberating and the traditional messages in schools. Feminists have, understandably, been much more interested in the latter and have tended to assume that these traditional messages are successfully inculcated into young girls. Anyon (1981) has pointed out, however, that many girls resist and fail to incorporate these messages. Girls are also exposed to the dominant values of achievement and success and can bend and adapt notions of femininity to their own needs. Our usual models of socialization have assumed too much passivity on the part of girls growing up.

Secondly, the literature on stereotyping emphasizes the way the stereotype produces underachievement in women. Horner's (1970) work on the motive to avoid success is probably the best known in this area, but many others have argued that femininity encourages a girl to pretend she does not know much and so to lower her aspirations to be intellectually passive. As Levy (1972) concludes, "masculine characteristics are related to intellectual development and self actualization, whereas the strong, consistent pressures on girls to be feminine and good pupils promote characteristics that inhibit achievement and suppress females' full development" (p. 1).

It could also be argued, however, that much of the female stereotype encourages social competence and enhances their achievement in school (Wine,

Moses & Smye, 1978). The negative valuation of things that are female leads to some bizarre consequences, common in the literature, such as prizing aggression, associated with males, and devaluing sociability, which is associated with females. Traits which are female are treated as causing low achievement while male traits are used to "explain" male success. The necessary relation is not so clear. When women do achieve, this achievement is devalued as conformity or doing what they are told. We need to look not only at how ideology depresses women's achievement but also at how it may explain the fact that women have by and large done very well in school. Its effects are more ambiguous than we have noticed. Instead of exploring only how schooling teaches girls characteristics that reflect their jobs in the labour force, we should also consider that schooling might teach girls social competencies that are in contradiction to their position at work.

Adding sex role beliefs into an occupational attainment model does help to predict expectations of labour force behaviour (Gaskell, 1977) and labour force participation (Smith-Lovin & Teckamyer, 1978). However, the effect is not very large. This is quite consistent with social psychological research on attitudes and behavior, which suggests that attitudes often do not predict behavior since there will be situational forces working for and against behavioral realization of attitudes (Acock & DeFleur, 1972; Andrews & Kandel, 1979). This will be true particularly of general attitudes such as sex role beliefs and of attitudes that develop in school before the actual contingencies of family life and the work force become real.

Moreover, attitudes towards work and femininity are responsive to events in the "real world" rather than being static attributes of the individual. Much of the behavior that is explained by women's acceptance of traditional ideology can also be explained by the effects of the opportunity structures they face. Robb and Spencer (1976), for example, conclude that it is quite rational for women not to invest in higher education given the low economic returns they can expect. Madden (1978) similarly shows how economic returns can predict women's educational decisions. Similarly, deciding to stay at home with children may reflect a paucity of real options for child care. We do not need to assume that women are "brainwashed" by traditional attitudes.

To summarize, in this section I have looked at ways that research has focused on what women bring into the labour market from the schools, particularly on what is different from and inferior to what men bring into the labour market from the schools. Women bring in different levels of achievement in school, different kinds of achievement in school, and socialization that has rewarded different traits and beliefs. But what women learn need not be seen as inferior to what men learn. And these differences may be a result as much as a cause of an unequal job structure. Focussing exclusively on sex differences tends to overemphasize the traditional, sexist nature of schools and produces an incomplete explanation of how schooling is involved in maintaining sex differences in the labour market. Working with this model has led researchers to look only for those differences in school that correspond to differences in the adult labour force. Contradictions and weak links have been glossed over. If a different model of the adult labour market is adopted, however, so that we do not assume that what is learned in school will cause what happens in the labour market, it is possible to look more squarely at the various aspects of what happens in schools.

Research on the structure of labour markets and their implications for education and training

Status attainment models and human capital theory assume an open, fully competitive labour market in which individual characteristics are identified and rewarded equitably. They assume the average worker in the average workplace and see what effects changes in education will have on this worker. They assume that the important difference among jobs is in the level of rewards they provide but that there are no significant differences in the way they attract and treat labour since all employers attempt to maximize profit.

Criticism of these models and their assumptions has been appearing with increasing frequency (Edwards, Reich & Gordon, 1975; Horan, 1978; Stolzenberg, 1978; Hodson & Kaufman, 1982). The notion of labour market segmentation is used to focus attention instead on differences among workplaces in their demand for and use of labour. Workers are allocated to labour markets and thus to workplaces through a variety of practices which classify workers on criteria which may be marginally related to their ability to perform the job. We know that information is not always accurate or perfectly communicated. Rigidities and discriminatory practices exist. What are desirable traits for one employer may be less important to the next, and school achievement may or may not be important.

Once workers enter a particular workplace, their careers will depend not just on their individual characteristics but on the structure of opportunities that are available there and on what has been called the structure of internal labour markets. Some firms provide fewer opportunities for mobility than others. Similar traits are rewarded differently in different firms and in different occupations. On-the-job training is only sometimes available.

Segmentation analysis suggests new ways to study the relationship between education and training and work. Education can be analyzed as part of the process of sorting and classifying workers and structuring labour markets. The relative importance of educational qualifications and of abilities and attitudes developed in the school can be examined for various kinds of workplaces and employers. But to do this, we need to turn to economic models which are not familiar in educational research. We also need to pay more attention to historical work on how the links between education and work were forged and how the particular structure of schools and their provisions for access to jobs were developed.

Segmentation analysis is particularly important for understanding women's experience in the labour force, as women by and large do different jobs from those of men. Women are heavily concentrated in a few occupations which employ mostly women — clerical, sales, service, and a few semi-professional jobs such as teaching and nursing. They are more likely than men to be employed in secondary jobs — i.e. in small, marginal firms. This occupational segregation by sex is very resilient, cannot be explained by individual characteristics, and shows few signs of declining (Gross, 1968; Armstrong & Armstrong, 1978). The characteristics of women's jobs can explain much about women's behavior in the labour market and vice versa.

There are two important characteristics of the jobs women do that help us explain the low economic returns women experience to their schooling. First, as Oppenheimer (1970) has pointed out, women's jobs systematically underpay for the years of education they demand. The roots of this can be traced historically. That women can be paid less than men was an established tradition before

industrialization and it was carried over with the support of employers and male workers into the new jobs women came to do (Hartman, 1976). Women moved into jobs that were expanding rapidly while funds to pay for the work were expanding less rapidly. The organization of training can reinforce low pay by providing a plentiful supply of qualified workers. While shortages will provide pressure to increase the wage, an oversupply allows low wages to be paid. Training for women's work has been lodged in the public schools more often than training for men's work. It is thus more accessible and will provide a larger supply of workers than training that is subject to higher entrance requirements or employer or union sponsorship.

Secondly, the jobs that women do provide few opportunities for on-the-job training, requiring instead extensive training before employment (Wolf & Rosenfeld, 1978). Clerical work and the semi-professions (nursing, teaching, librarianship, etc.) all have this character. The jobs women hold in small marginal firms and in the clerical, sales and service areas tend to have less chances for on-the-job training and promotion than the jobs men hold.

Canada Manpower Statistics (Statistics Canada, 1980a) show both the under-representation of women in on-the-job training and the segregation of women into particular kinds of on-the-job training. Women constitute only 27% of all trainees, these being concentrated in stenographic and clerical trades and inservice occupations, particularly medical and health services. Statistics on other forms of on-the-job training which are not subsidized by the government would undoubtedly reveal these patterns even more strongly.

The examination of these patterns raises a number of new questions and areas for educational research and suggests new explanations of why women get the kind of education they do and why it does not help them much in the workplace. The organization of vocational training as it is presently structured must not be taken for granted but requires an historical and dynamic analysis of why it takes the shape it does and why it changes in relation to the organization of the workplace. Why does women's vocational training tend to take place in the public school system, while training for jobs men hold takes place on the job? What changes might be made in the structure of work and schooling? These questions focus not on women themselves as the problem but on the structure of education and work as it has been and is still negotiated between employers, government and educators.

Some starting points in the investigation of the training of women

Research on the structure of training for women's work is not as well known as the research discussed in the first part of this paper. There is also not as much of it. In this section, I will begin to draw on some of it to suggest the directions in which more research should proceed and the questions that I have found provocative and unanswered. It should be clear that this is only a beginning; as more research along these lines takes place, the shape of an alternative approach will become clearer.

The organization and development of the high school curriculum is one area to explore. Katherine Poss (1981) has suggested that the public high school was originally set up to provide job preparation for women. "Up through the 1880's, a major function of the high school was to provide the public elementary schools with female teachers." Then, starting in the late 19th Century the public high

school began to provide commercial education. Thus the public high school was providing a solid vocational preparation for girls, while the links between education and a young man's future were much more tenuous.

Commercial education has remained the one area of the high school curriculum that prepares students directly for jobs, despite the introduction of more vocational courses for boys (Gaskell, 1981). A girl who graduates from them acquires typing and shorthand skills which cannot be picked up on the job and which are likely to be tested before she can get the job. Girls who take commercial courses do better in the labour market than girls who do not take the courses (Nolfi, 1978; Gaskell, 1981b).

The industrial courses which appear to be the equivalent courses for males are not as closely linked to work. They do not provide credentials or skills that are tested or expected on entry to jobs. The student who has taken carpentry is not a carpenter. The student who has taken auto mechanics is not a mechanic. Trades training takes place after high school, usually while a worker is being paid, and research suggests it is boys in the academic programme rather than in the industrial program who will be preferred because of their higher status (Nolfi, 1978; Little, 1970). There have been some recent attempts to introduce pre-apprenticeship programs into the high school, but proposals to create alternatives to apprenticeships at the community college or to subsidize employers to provide the training on the job remain more popular.

Our usual assumption that the difference in the location and organization of training is due to the nature and difficulty of the tasks is at most only a partial explanation. Clerical work is less expensive to start in schools. However, expensive machines exist in school shops and experience in settings outside the school is used in commercial courses and could be used in others. We must monitor the impact of the increasingly expensive computer equipment that is being introduced into offices.

One might argue, to use Becker's (1964) typology, that clerical skills are "general" skills that can be transported from one employer to another while industrial skills are "specific" and of use only in a particular firm. While it would be economically rational for an employer to train for skills that are firm-specific, it would not make sense for him to provide general training as he would be subsidizing other employers who do not engage in this kind of training. The state would then have to step in to provide general training.

But commercial courses provide more than general skills. They go beyond teaching typing to include office-specific machines, practices, and work simulations. Many of the skills taught in the commercial courses do not apply widely in the job market. Many of the machines used in schools are not used in offices; the particular letter format that is learned by a girl in school may well not apply to the office in which she works. Moreover, recent attention to industrial skills has pointed out that there are many generic skills that are useful in a wide variety of industrial settings (Smith, 1975). Employers' reluctance to hire and train apprentices is often phrased in terms of the general nature of the skills that are learned and the fact that other employers quickly attempt to hire trained workers (Ministry of College and Universities, 1973; Harvey, 1980).

Not just the technology and skills but the social organization of clerical work and the fact that women did the work had an important influence on how its training took place. The power of women as workers is one issue. While male

unions had some success in restricting the supply of skilled workers through apprenticeships and negotiated contracts (Palmer, 1979; Rule, 1981) women were unable to do the same thing and large numbers of teachers and clerical workers were trained in the public school system.

The reluctance of employers to invest in women is another issue. Thurow (1975) has argued that employers will minimize investing in groups "known" to have a low attachment to the labour force. The longer an employee stays with a firm, the longer the period over which the firm can receive returns on its investment. Women are seen as short term employees likely to stop work and return to the home. If a man threatens to change jobs, "The employer will at least have the opportunity to bribe the employee to stay. Such countervailing bribes would be less effective in stopping women from having children" (p. 178). As there is no assumption that women will stay and take much responsibility in the firm there is less necessity to control their training and more willingness to trust public schools to do at least an adequate job. These assumptions need not be true to be influential. The form of training that has developed becomes a self-fulfilling prophecy encouraging intermittent work histories because the jobs provide for no long term careers.

In clerical work, therefore, the rapidly expanding demand for cheap labour, the reluctance of employers to invest in on-the-job training for women, and the feminization and lack of unionization of clerical work all contributed to its emergence as part of the high school curriculum (Dunn, 1979). Unions concerned about restricting the supply of labour and employers willing to invest in men prevented this from happening to the trades, whatever vocational courses were added to the curriculum.

The development and organization of vocational training at the community college requires a similar kind of analysis of a process that continues to unfold. The rapid increase in courses at the community college level suggests that training for a variety of jobs is getting changed from a relatively informal process of on-the-job learning supervised and paid for by the employer to a formal credit course at a public institution under the supervision of specialized teachers. Educational requirements for jobs are becoming more standardized and rationalized. Although this process may reduce labour costs and increase profits as some have claimed (Pincus, 1980), it is taking place more in some areas than others. The increasing representation of women at community colleges suggests that it may be "women's work" that is particularly subject to this kind of reorganization and upgrading of pre-entry educational requirements. For example, child care programmes, which tend to be overwhelmingly female, have been instituted. Associations of child care workers have lobbied for the recognition of their training by day care centres and for the exclusion of anyone who does not have formal credentials from teaching at a day care centre. The success of this attempt to "upgrade" the work will depend on a variety of factors in the marketplace: the organization of funding, the supply of workers, the way work gets reorganized, the political power of the occupational group, the use of new technology, and so on (Wein, 1979). These are the same factors that affected the organization of clerical and industrial courses in high schools. At the same time, the areas where community colleges do not develop and expand courses need to be examined. Either unions or employers or both may want to restrict the supply of labour, keep it unskilled or exercise more control over the selection of students and the content of their training than public institutions allow.

At the university, the same relations can be investigated. The organization of university courses in relation to the labour market is different in different areas. In many professional and semi-professional areas the degree obtained is necessary in order to work in the area, for example, in education, medicine, architecture, and law. This relationship has become stronger over time in some areas. For example, in teaching it used to be common to be able to teach without a university certificate. These days it is not. In other areas, the dominance of professional qualifications is questionable. Graduates in engineering and commerce are employed in a wide variety of areas and may compete with arts graduates for the same job (Ahamed, Greenberg, Desroches, Mitchener, Cartier & Brown, 1979).

Relations between university training and professional work develop and change over time, reflecting the power of the professional group to control the supply of labour. Collins (1979) provides an account of how doctors and lawyers were able to control access to their occupations, excluding midwives and barber-surgeons for example, through the nature of the training process. Engineers were less successful at controlling training processes. We can assume that women have had less power to insist on a formal and long credentialling process for the jobs that they do.

Looking at the structure of training will partially explain both how much and what kind of education women get. If they can get skilled jobs in offices with a high school education they will complete high school but be less likely to go on to higher education than if these jobs rewarded higher educational levels. If taking business courses in high school provides them with job skills they cannot get elsewhere, they are likely to opt for the business courses rather than the industrial or academic ones. If entrance into nursing training requires grade 12 science and mathematics, girls wanting to be nurses will try them.

The structure of training will also partially explain changes in women's access to nontraditional job areas and higher paying occupations. A long training program may discourage some women who do not plan to stay in the labour force for a long time and thus reduce their access to jobs they have traditionally held. For instance, using the child care example, women who used to be qualified because they had brought up children would now have to return to school or be relegated to a lower paid job ghetto made up of informal babysitting in the home. On the other hand, a formal educational program may increase the attention paid to ability and open recruitment more widely so that women have more access to nontraditional jobs. As has been pointed out, women do relatively well at school and have tended to stay there longer than men. They are overrepresented as students at the community college level. Increased training may increase women's wages by upgrading the quality of their labour and decreasing its supply. On the other hand, public training programs may open training opportunities more widely and devalue them.

Many of these questions remain open and need further research. We must pay more attention to them. It is not enough to concentrate on what women are like and what they choose in order to understand the relation between their education and their work. We must look at the organization of education in the areas that women work, and see how the organization of jobs produces particular patterns of labour force activity and school attendance. Changes in the organization of work and training, not just changes in women themselves, are necessary to increase the economic position of women. Occupational segregation by sex must be diminished. Jobs where women predominate need to be reorganized to include more on-the-job

training and more potential job ladders. These changes in work can have an impact on women's economic returns to education, on the educational decisions women make, and on the organization of public schooling.

Concluding observations

I have argued that research on women in schools needs to focus more on the structure of vocational preparation for women and to examine the reasons that women are unable to translate their educational achievements into success in the labour market. This would represent a shift in emphasis from research on the inferiority of women's schooling and on their socialization into traditional roles. As I have argued, this shift can be justified partly because existing research cannot account fully for what we see in the labour force, and partly because it is based in theoretical assumptions that are too simplistic.

However, the political and ideological implications of such a shift also need to be considered. Research on what is wrong with women's achievement or ideology tends to do what Ryan (1971) has called "blaming the victim" — locating "the stigma, the defect, the fatal difference — though derived in the past from environmental forces — within the victim" (p. 7). This kind of analysis is congruent with basically liberal notions of equality of opportunity — that anyone can make it if they are intelligent and try hard — and with psychological notions of development — that early experience is critical in determining later achievement. But these notions are fundamentally conservative (McPherson, 1965; Kagan, 1978) and should not provide the only way of framing research questions. They lead to, as Ryan notes, "a perverse form of social action designed to change, not society, as one might expect, but rather society's victim" (p. 7). For women they lead to strategies to give girls more information about the labour market, to have them consider nontraditional careers, to reduce their mathematics anxiety and so on, but not to strategies to change the structure of opportunity women confront.

References

- Acock, A., & DeFleur, M. A configurational approach to contingent consistency in attitude-behavior relationship. *American Sociological Review*, 1972, 37, 714-26.
- Ahamad, B., Greenberg, J., Desroches, J., Mitchener, R., Cartier, N., & Brown, A. *Degree holders in Canada: An analysis of the highly qualified manpower survey of 1973*. Ottawa: Education Support Branch, Dept. of Secretary of State, 1979.
- Alexander, K. L., & Eckland, B. K. Sex differences in educational attainment. *American Sociological Review*, 1974, 39(5), 668-682.
- Andrews, K., & Kandel, D. Attitude and behavior. *American Sociological Review*, 1979, 44, 298-310.
- Angle, J., & Weissman, D. Gender, college major and earnings. *Sociology of Education*, 1981, 54, 25-33.
- Anisef, P., Paasch, J., & Turritin, A. *Is the die cast? Educational achievements and work destinations of Ontario youth*. Toronto: Ministry of Colleges and Universities, 1980.
- Anyon, J. Accommodation, resistance and female gender. Paper presented at the International Sociology of Education Conference, Birmingham, England, 1981.
- Armstrong, P., & Armstrong, H. *The double ghetto: Canadian women and their segregated work*. Toronto: McClelland & Stewart, 1978.
- Becker, G. S. *Human capital*. N.Y.: Columbia University Press, 1964.
- Berg, I. *Sociological perspectives on labour markets*. New York: Academic Press, 1981.

- Bielby, D. Career sex-atypicality and career involvement of college educated women: Baseline evidence from the 1960's. *Sociology of Education*, 1978, 51(1), 7-28.
- Blau, P., & Duncan, O. *The American occupational structure*. N.Y.: John Wiley & Sons, 1967.
- Boulet, J., & Lavallee, L. *Women and the labour force: An analytical framework*. Discussion Paper No. 207. Ottawa: Economic Council of Canada, 1981.
- British Columbia Department of Education. *Annual report of the public schools*, Victoria.
- Boyd, M. Sex differences in the Canadian occupational attainment process. *The Canadian Review of Sociology and Anthropology*, 1981, 19(1), 1-28.
- Byrne, E. *Women and education*, London: Tavistock Publications, 1978.
- Clarricoates, K. The experience of patriarchal schooling. *Interchange*, 1981, 12(2-3), 185-205.
- Collins, R. *The credential society*. New York: Academic Press, 1979.
- Delamont, S. *Sex roles and the school*. London: Methuen, 1980.
- Devereaux, M. S., & Rechnitzer, E. *Higher education-hired?* Ottawa: Statistics Canada, 1980.
- Dunn, T. Teaching the meaning of work: Vocational education in British Columbia. 1900-1929. In Jones, Sheehan & Stamp (Eds.), *Shaping the schools of the Canadian West*. Calgary: Detselig Enterprises, 1979.
- Edwards, R., Reich, M., Gordon, R. Labour market segmentation. Lexington, Mass.: Heath, 1975.
- Featherman, D. L., & Hauser, R. M. Sexual inequalities and socioeconomic achievement in the U.S. 1962-73. *American Sociological Review*, 1976, 41, 462-483.
- Finn, J., Reis, J., & Dulberg, L. Sex differences in educational attainment: The process. *Comparative Education Review*, 1980, 33-52.
- Fischer, L., & Cheyne, J. *Sex roles: Biological and cultural interactions as found in social science research and Ontario educational media*. Toronto: Ministry of Education, 1977.
- Fox, L. *The problem of women and mathematics*. A report to the Ford Foundation, 1981. Available from the Ford Foundation, 320 East 43 St., New York.
- Gaskell, J. Sex role ideology and the aspirations of high school girls. *Interchange*. 1977, 8(3), 43-53.
- Gaskell, J. Equal educational opportunity for women. In J. D. Wilson, *Canadian education in the 80's*. Calgary: Detselig Enterprises, 1981.(a)
- Gaskell, J. Sex inequalities in education for work: The case of business education. *Canadian Journal of Education*, 1981, 6, 54-72.(b)
- Gaskell, J. Education and career choice: Enrollment data and beyond. In M. Kinnear & G. Mason, *Women and work*. Institute for Social and Economic Research, University of Manitoba, 1983.
- Gibbons, R., Ponting, J. R., & Symons, G. Attitudes and ideology: Correlates of liberal attitudes towards the role of women. *Journal of Comparative Family Studies*, 1978, 9(1), 19-40.
- Goyder, J., & Pineo, P. Female occupational achievement. Paper presented at Annual Meeting of Canadian Sociology and Anthropology Association, Kingston, Ontario, 1973.
- Granovetter, M. S. *A study of contacts and careers*. Boston: Harvard University Press, 1974.
- Gross, E. The sexual structure of occupations: Plus ça change. *Social Problems*, 1968, 198-208.
- Hartman, H. Capitalism, patriarchy, and job segregation by sex. In M. Blaxdall & B. Reagan, *Women and the workplace*. Chicago: University of Chicago, 1976.
- Harvey, E. B. *Barriers to employer sponsored training in Ontario*. Toronto: O.I.S.E., Publications, 1980.
- Herzog, A. R. High school seniors' occupational plans and values: Trends in sex differences 1976 through 1980. *Sociology of Education*, 1982, 55, 1-13.

- Herzog, A. R., & Bachman, J. G. *Sex role attitudes among high school seniors*. Research Report Series, Institute for Social Research, University of Michigan, 1982.
- Hodson, R., & Kaufman, R. Economic dualism: A critical review. *American Sociological Review*, 1982, 47, 727-739.
- Horan, P. Is status attainment research atheoretical? *American Sociological Review*, 1978, 43, 534-540.
- Horner, M. Femininity and successful achievement: A basic inconsistency. In J. Bardwick (Ed.), *Feminine personality and conflict*. Belmont, Calif: Brooks Cole, 1970.
- Jencks, C. *Inequality*. New York: Basic Books, 1972.
- Jencks, C. *Who gets ahead*. New York: Basic Books, 1979.
- Kagan, J. *Infancy*. Boston, 1978.
- Kimball, M. Women and science: A critique of biological theories. *International Journal of Women's Studies*, 1981, 4, 318-338.
- Levinson, R. M. Sex discrimination in employment practices: An experiment with unconventional job inquiries. *Social Problems*, 1975, 22(4).
- Levy, E. Do teachers sell girls short? *Today's Education*, National Education Assoc., 1972.
- Little, J. K. Review and synthesis of research on the placement and follow-up of vocational education students. ERIC Research Series No. 49, VT 010 175. Centre for Vocational and Technical Education, Columbus, Ohio, 1970.
- Lueptow, L. Sex typing and change in occupational choices of high school seniors: 1964-1975. *Sociology of Education*, 1981, 54, 16-24.
- Maccoby, E., & Jacklin, C. *The psychology of sex differences*. Stanford, California: Stanford University Press, 1974.
- Madden, J. Economic rationale for sex differences in education. *Southern Economic Journal*, 1978, 44, 778-797.
- Marsden, L., Harvey, E., & Charner, J. Female graduates: Their occupational mobility and attainments. *Canadian Review of Sociology and Anthropology*, 1975, 12(4); 385-405.
- McPherson, C. B. *The real world of democracy*. Toronto, 1965.
- Ministry of Colleges and Universities Manpower Training Branch, *Training for Ontario's future: Report of the Task Force on Industrial Training*, 1973.
- Nolfi, G. *Experiences of recent high school graduates*. Lexington, Mass.: Lexington Books, D.C. Heath & Co., 1978.
- Oppenheimer, V. *The female labour force in the U.S.*. Berkeley, California: Institute of International Studies, 1970.
- Palmer, B. *A culture in conflict: Skilled workers and industrial capitalism in Hamilton, Ontario 1860-1914*. Montreal: McGill-Queen's University Press, 1979.
- Parsons, J. Sex differences in mathematics participation. In Steinkamp & Maehr, *Women in Science*, Greenwich, Conn: JAI Press, in press.
- Perspective Canada: A compendium of social statistics*. Ottawa: Information Canada, 1974.
- Picot, G. *The changing educational profile of Canadians, 1961 to 2000*. Ottawa: Projections Sections, Education Science and Culture Division, Statistics Canada, 1980.
- Pincus, F. The fake promise of community college: Class conflict and vocational education. *Harvard Educational Review*, 1980, 50, 332-361.
- Poss, K. The sexual structuring of public high school education, 1870-1930. Paper prepared for Western Association of Women Historians conference, Asilomar, California, 1981.
- Rezler, A. Characteristics of high school girls choosing traditional or pioneer vocations. *Personnel and Guidance Journal*, 1967, 45(7), 659-65.
- Richer, S. Sex role socialization and early learning. *Canadian Review of Sociology and Anthropology*, 1979, 16(2), 195-205.

- Robb, A. L., & Spencer, B. G. Education: Enrolment and attainment. In G. Cook (Ed.), *Opportunities for choice a goal for women in Canada*. Ottawa: Information Canada, 1976, 53-91.
- Rossi, A. Barriers to career choice of engineering medicine or science among American women. In Mattfeld & Aken, *Women and the scientific professions*. Cambridge, Mass.: M.I.T. Press, 1965.
- Royal Commission on the Status of Women. *Status of women in Canada*. Ottawa: Information Canada, 1970.
- Rule, J. *The experience of labor in the 18th century*. London: Croom Helm, 1981.
- Russell, S. Learning sex roles in high school. *Interchange*, 1979, 10(2), 57-66.
- Ryan, W. *Blaming the victim*. New York: Random House, 1971.
- Scott, J. Science subject choice and achievement of females in Canadian high schools. *International Journal of Women's Studies*, 1981, 4, 348-361.
- Smith, A. D. W. *Generic skills research and development*. Manpower & Immigration, Training Research and Development Station, Prince Albert, Saskatchewan, 1975.
- Smith-Lovin, L., & Teckamyer, A. Labor force participation, fertility behavior and sex role attitudes. *American Sociological Review*, 1978, 43, 541-557.
- Sokoloff, N. *Between money and love: The dialectics of women's home and market work*. N.Y.: Praeger, 1980.
- Statistics Canada. *Women in the labour force*. 1977 Facts and Figures. Part 2, Earnings of women and men. Ottawa: Women's Bureau, Labour Canada, 1979.
- Statistics Canada. *Women in the labour force*, 1977 edition, Part 3. Ottawa: Women's Bureau, Labour Canada, 1980.(a)
- Statistics Canada. The employment of 1976 university and college graduates. Document 4-2212-520. Ottawa: Education, Science and Culture Division, 1980.(b)
- Stolzenberg, R. Bringing the boss back in. *American Sociological Review*, 1978, 43(6), 813-829.
- Synge, J. The sex factor in social selection processes in Canadian education. In Carlton, Colley & McKinnon, *Education, change and society*, Toronto: Gage Publishing Ltd., 1977.
- Thurow, L. *Generating inequality*. New York: Basic Books, 1975.
- Walshok, M. *Blue collar women*. Garden City: Anchor Press, 1981.
- Wein, F. The institutionalization of low income occupational groups in Nova Scotia. Marginal Work Worlds Project, Dalhousie, 1979.
- Weiss, J. *Educating for clerical work: A history of commercial education in the United States since 1850*. Doctoral thesis, Harvard University, 1978.
- Wilms, W. W. Public proprietary vocational training: A study of effectiveness. Berkeley: University of California Centre for Research and Development in Higher Education, 1974.
- Wine, J. The reproduction of female relationality. In P. Olson & M. Griffiths *The political economy of gender relations in education*. Boston: Routledge & Kegan Paul, forthcoming.
- Wine, J., Moses, B., & Smye, M. Female superiority in sex difference competence comparisons: A review of the literature. In Stark-Adamec (Ed.), *Sex roles*. Montreal: Eden Press, 1978.
- Wolf, W., & Fligstein, N. Sexual stratification: Differences in power in the work setting. *Social Forces*, 1979, 58(1), 94-105.
- Wolf, W., & Rosenfeld, W. Sex structure of occupations and job mobility. *Social Forces*, 1978, 56(3), 823-844.
- Zur-Muehlen, M. Graduation trends in the 60's and 70's. *University Affairs*, 1982, 5, 9.

Linking Educational Research and Educational Policy Via Policy-Relevant Research

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At present, policy research seems to exist in two quite different forms. In the first, it tends to be a sub-category of evaluation research or, more generally, of traditional social science research, and is carried on by academic researchers with the results published in the normal journals. It is this form of policy research which James Coleman describes in some detail in *Policy Research in the Social Sciences* (1972b). It concerns itself with the *impact* of policies and, according to Coleman, can take two forms, input/output studies of the Equality of Educational Opportunity (1966) type, or preferably social audit studies which trace the flow of resources, focussing on their diversion from intended recipients.

In the second form, policy "research" typically consists of a debate (formal or discontinuous) in which various parties advocate various solutions to a policy problem, often without any thorough statement of the issue or any careful attempt to identify a range of feasible alternative solutions. The policy adopted is generally a function of who happens to be in the appropriate place at the time (often unannounced) for a final decision. Such research, conducted largely by the policy-makers themselves, in fact produces the vast majority of the policies which guide our various social enterprises, from universities to lotteries. There are a number of exceptions, in which typically some academic researchers are gathered together in a centre to conduct policy research. In Canada the Alberta Human Resources Research Council during its life span provided an excellent example (see Housego, 1978). The Hudson Institute or the Rand Corporation provide examples from the United States. There are also some self-conscious attempts to use general social science research findings in decision-making (see, e.g., Egnatoff, 1978). But there are probably thousands of public policy decisions made every

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day, in school board meetings, in local government, state, provincial and federal agencies, in Crown corporations, in universities, and elsewhere which conform to the definition of research given above.

The lack of useful communication (see, e.g., Caplan, Morrison, & Stanbaugh, 1975) between these "two communities" of policy researchers helps to account for the failure to use research findings (Rich, 1979, p. 7), and is clearly disadvantageous to the societies served by the policy process and the resulting social programs. Although an enormous amount of money is spent in research and development activity, particularly in the United States (Cohen & Garet, 1975, estimate two hundred million dollars annually on education alone), there is still little systematically verified knowledge about how to maximize the utility of research in policy-making. At present we are seeing the results of a number of efforts to apply research methods to this problem. A recent study by Mitchell (1980) adopted what seems to be a particularly productive approach to the issue.

Using data from interviews with 160 legislators in three western states, Mitchell first identified phases in the policy-making process and the subsequently linked social science research utilization to each of the phases. The four distinct phases in policy development in state legislatures are: *articulation*, turning diffuse demands into specific proposals for legislation; *aggregation*, pooling similar interest to support a particular policy or building consensus; *allocation*, accepting and adopting a particular policy statement; and *oversight*, the subsequent review of the impact of a particular policy. It is our contention that not only do each of these phases have different research needs, but that these needs require different types of research. We will argue that the needs of the articulation and oversight phases are being served to some extent by current research efforts, but that the needs of the aggregation and allocation phases which constitute the heart of the policy making process are not.

In order to serve the needs of the aggregation and allocation phases, research must emphasize policy concerns throughout the process of problem formulation, data collection, and interpretation. In this paper such a research model is proposed. It describes the characteristics of this form of research, which the authors have labelled Policy-Relevant Research (PRR), its relationship to public policy-making as this process is analysed by Mitchell (1980), and its relationship to other forms of social science research, from the perspective of utility to policy-makers. This model of policy-relevant research was developed from analysis of an evaluation study which the authors had undertaken and with which they felt some dissatisfaction. Thus it is necessary to provide, first, a brief description of the study and its findings and, second, a critique of the study as a piece of policy research.

A Follow-up Study of the Opinions of High School Graduates

The evaluation study was intended to provide information to school district policy-makers regarding the opinions of recent graduates of the district about their school experiences in the various secondary schools. An Advisory Committee of district staff monitored the project closely, and many of the basic decisions were taken in committee. The entire population from three recent graduating years — 1975, 1977, and 1979 — was surveyed. This was intended to reduce the unreliability resulting from low return rates in a random sample. Of 2919 survey forms mailed out, 929 (32%) were returned, a common enough figure for large

surveys of graduates of high schools (Smedley & Olsen, 1975). To support the survey data, telephone interviews with a stratified random sample of graduates were conducted.

Three different student profiles, or configurations of characteristics, emerged from the interviews. The first profile was provided by students who, while in school, had planned to proceed to university studies; in every case their choice of university program was influenced by the high school courses they enjoyed and in which they did well. Further, their assessment of various school experiences was based almost entirely on how well these experiences prepared them for university study. Their assessments were generally positive. The second profile was provided by students who planned a specific kind of employment, with or without further non-university training. Their assessments of their school experiences were essentially similar to those of the first group, both in being based on the utility of school experiences as preparation and in their generally positive tone. The third profile was provided by students who had no idea, while in school, of what they were going to do after school, and is quite different from the other two profiles. Their school experiences had little meaning for them and they tended to be cynical, bitter, and negative about every aspect of schooling.

The initial analysis of the survey data used year of graduation and school as the independent variables. These did reveal some significant associations, notably in differences between schools, but the interview data caused the investigators to reanalyze the survey data, using certainty of career plans as the independent variable.

The questionnaire data established that certainty of postschool plans was significantly related to attitude towards school. For example, nearly all the high certainty respondents graduated, whereas over 10% of the low certainty respondents were school-leavers, almost twice the nongraduation rate in the district. Furthermore, a significantly larger percentage of high certainty respondents expressed positive attitudes towards various aspects of their high school experience than did low certainty respondents. For example, 78% of the high certainty respondents rated teachers favourably, compared to 64% of the low certainty respondents. The corresponding figures for high school experience in general were 72% and 53%; for variety of career, vocational, or business courses, 70% and 47%; for quality of academic courses, 69% and 62%; and for quality of career, vocational, or business courses, 54% and 38%.

The interview data helped to explain the nature of the relationship between certainty of postschool plans and attitude towards school. The respondents who had at least a general idea of what they wished to do after leaving school had a basis on which to select courses. They viewed many of their courses as a preparation for what they intended to do later and, not surprisingly, found them to be relevant and meaningful. In other words, having postschool plans was a major contributing factor to positive attitudes towards school. The picture presented by the low certainty respondents was precisely the opposite. Not knowing what they wanted to do after leaving school, they had no reason for selecting one course over another, they could see little utility for the future in what they were doing in school, and thus they felt dissatisfied and even bitter.

Given that certainty of postschool plans does contribute to positive attitudes towards school, the question facing policy-makers is how best to help students develop career plans. A significantly larger percentage of high certainty

respondents rated as helpful various influences on the planning of their careers than did low certainty respondents. The figures for teachers, counsellors, guidance classes, and family members were, respectively: 47% to 21%, 29% to 14%, 26% to 15%, and 73% and 62%. Again, the interview data helped to interpret these findings. The high certainty respondents did not rate either the counsellors or the guidance classes as helpful, but they did not expect them to be. The major influences on the career plans of high certainty graduates were their family and nonschool experiences. They tended to turn to counsellors only for specific information. Also, they described teachers as helpful influences, but mainly in the refinement and directing of initial plans rather than in their formulation. The low certainty respondents, on the other hand, needed help in developing career plans. They did not feel that they were given the help they needed, and this also contributed to their dissatisfaction.

Taken together, the two types of data supported the following major conclusion of the study:

Student intentions or purposes are extremely important determinants of the student's experience in school: students who have a goal, particularly one which involves post-secondary study, are unlikely to drop out, are very likely to find high school teachers and courses relevant and satisfying, and generally rate their high school experience quite positively. Students without a clear-cut goal are not helped to develop one by the schools, and are more likely to drop out and to have negative perceptions about everything about the school, including especially the guidance program. (Coleman & LaRocque, 1981, p. 32)

The major policy implication of the study emerged from this conclusion. A revised role for high school counsellors and for guidance classes, in which early identification of goal-less students and very intensive career planning work with these students was made the major responsibility of counsellors was recommended. It was concluded that "a reduction in the number of students without career goals would, it seems likely, reduce the number of dropouts, and increase student satisfaction with the secondary school" (Coleman & LaRocque, 1981, p. 33) of the school district, certainly a desirable policy objective.

After completing the study, the writers experienced some dissatisfaction with it as a piece of policy research. In order to be policy-relevant, the research should have been concerned with causality, with the complexity of the problem and the setting in which it exists, and with utility, that is, the possibility of policy-makers acting on the findings and recommendations. When the study is examined from each of these three aspects, it may be judged somewhat satisfactory in the first case, but less so in the latter two.

With regard to causality, three features of the study contributed independent but corroborative evidence about the relationship between postschool plans and student satisfaction.

First, the use of both survey data and interview data allowed causal rather than simply associational inferences to be drawn, and in particular suggested a reanalysis of the survey data which would probably not have been considered without the clues provided by the interview data. In fact, it probably would have been preferable to have used interviews to seek possible causal associations, which would then have been investigated in a more carefully designed survey, reversing the actual sequence in this study. In general, the use of both survey and interview illustrates the point made by Cook and Reichardt (1979) on the utility of using features from both qualitative and quantitative research paradigms.

Second, the use of three cross-sections (1975, 1977, 1979), while not providing the quality of data of the properly longitudinal study (see Smedley & Olsen, 1975, on the merits of follow-through rather than follow-up studies of graduates), made it clear that student opinions of schools were relatively stable, which allowed the inference that the schools were not changing very much. More importantly it showed that the variable of student plans was of continuing importance, and not simply a temporary feature of a single student cohort.

The focus upon the plan-less students in the reanalysis of the initial data, rather than the majority of students, constitutes a focus on exceptions rather than norms. Most studies of student opinion have suggested that 80% of students have generally positive feelings about schools and have concerned themselves with the sources of these positive feelings, when they have been analytical at all. (See, for example, Jackson's review of a long tradition of such studies, 1968.) In this instance, the exceptions do indeed reveal more about causality than do the satisfied students: the link between career plans and student satisfaction is not found in previous studies, at least not as a major predictor.

With regard to complexity, the study was less satisfactory. Previous research on graduates has focused on a number of traditional items, including the contribution of various school factors, like teachers or programs, to satisfaction, and the reasons for leaving school without graduating. These studies were used to generate items for the survey, and the results did reaffirm, for instance, the positive way in which students perceive teachers, particularly teachers who demonstrate commitment. The question arises, however, of whether there were other, more important factors which affect student satisfaction. A reversal of the sequence of the study, with interviews preceding the construction of the survey, would certainly have allowed the identification of a number of different variables with a more careful multivariate analysis being possible.

Similarly, interviews with students still in school, and some further investigation of the school settings and the work of counsellors, at present, would have provided confirming or disconfirming evidence for the conclusion of the study that certainty of post high school plans was a major variable affecting every aspect of the students' school experience. Both these steps would have contributed also to providing a more carefully formative analysis of factors influencing student perception.

Finally, with regard to utility, the assessment of the study is mixed. On the one hand, the recommendations did focus on one variable, certainty of student plans, which is to some extent manipulable by the policy-makers. On the other hand, although the study was concerned with utility, and from the beginning dealt with an Advisory Committee of district staff in the hope that this would contribute to the eventual use of the results of the study, the overall utility of the study is still in doubt because receipt of the report was resisted by school district authorities at higher levels in the hierarchy than members of the Advisory Committee. The findings revealed a persistent pattern of differential effectiveness between high schools, reflecting negatively on some educators in some schools. Although the report provides at least one major suggestion for improving schools, it is not likely to be seen by significant policy makers in the district because of the negative findings. Thus, the researchers were insufficiently thoughtful about the political environment, and the final report should have been written differently if utility of the data was a prime concern. In the final analysis the

report approximated a traditional evaluation study of a school district, rather than a piece of policy relevant research, because of this failure of political sensitivity.

Policy-Relevant Research

In order for research findings to be utilized during the aggregation and allocation stages, that is, to be policy-relevant, research should be addressed specifically to policy-makers, should investigate problems which are of concern to them, and should be designed to provide data and interpretations which have predictive utility concerning the probable consequences of policy options. Furthermore, PRR should concern itself with those policy options which are important to policy-makers, because they are normatively acceptable and have some face validity as solutions to the perceived problems.

Based on analyses of the follow-up study we would argue for the utility, during the decision-making phases of policy-making, of a particular form of research which we have labelled policy-relevant research. Unlike typical evaluation research it is explicitly intended to help decision-makers influence the future by providing relevant and reliable predictive generalizations. Its central concerns are causality, the complexity and multivariate nature of events in naturalistic settings, and utility, as the following characterization of PRR demonstrates.

1. Policy-relevant research should be concerned with causality rather than association and, hence, should:
 - a. be longitudinal to allow for the manipulation of variables, either deliberately or through “natural experiments,” in the search for causality, and to allow temporary variations in relationships to disappear (see Bronfenbrenner, 1975, on long-term studies, including Project Follow Through);
 - b. employ both qualitative and quantitative techniques with the qualitative data guiding the collection and interpretation of the quantitative data (Cook & Reichardt, 1979); and
 - c. focus on exceptions as often as regularities because exceptions can be more revealing about causality. See, for example, the research on over- and underachieving schools, the “outliers” in traditional evaluation research (Wilder, 1977), or on over- and underachieving students (Asbury, 1974).
2. Policy-relevant research should assume complexity, that is,
 - a. assume that relationships in education are multivariate, with large effects from any single variable being rare and threshold effects and curvilinear relationships being as or more common than linear ones (see, e.g. Centra & Potter, 1980);
 - b. be concerned with naturalistic settings and analyses which preserve the holistic quality of the setting (e.g., *Life in Classrooms*, Jackson, 1968; *The Man in the Principal's Office*, Wolcott, 1973); and
 - c. make frequent use of measures and designs which reveal the contribution of various factors to outcomes, rather than of designs intended to demonstrate discrepancies, such as those between outcomes and objectives (see, e.g., Cain & Hollister, 1972, on outcome evaluation via discrepancies).

3. Additionally, policy-relevant research should be concerned with utility at every stage of the research, rather than addressing this in a postscript on policy implications, and hence should:
 - a. focus on variables manipulable by policy-makers rather than simply on statistically significant variables (see Levin's use, 1970, of data from the Coleman Report, 1966); and
 - b. be sensitive to the political environment and to uses likely to be made of the research findings (Sroufe, 1977).

These suggestions, particularly with reference to the concern with causality, are not novel, and certainly do not dispose of the issue. However, the deliberate adoption of the strategies suggested here at the planning stage of the inquiry will, we believe, provide much better informed interpretations of quantitative data and their significance than are otherwise possible.

The mood of uncertainty and uneasiness about the political uses made of the results of program evaluations in the 1970s, already described, has resulted in suggestions for change in research methodologies. For example, Rist (1981) argues for qualitative research rather than quantitative research as a better way of isolating the "levers of change" available to policy-makers.

Quantitative research frequently emphasizes a form of "hit and run" social science whereby pre- and post-tests become the basis for not only conclusions about treatment effects, but about policy implications as well. This approach is increasingly coming to be seen as only marginally useful at best and outright dangerous at worst. Having little or no idea about what worked or why, but only that relations were statistically significant is not a particularly informative contribution to the needs of the policy-maker. (p. 490)

Another suggestion, made from an evaluation research perspective, focusses on strengthening the causal links which sometimes coexist with significant associations. Scriven's Modus Operandi (MO) method for maximizing the power of causal investigations is essentially the inverse of the logical process typically identified as rational policy-making (see, e.g., Anderson, 1971). The problem Scriven addresses is the identification of cause or causes of a particular phenomenon. The MO method, common amongst practitioners such as automobile mechanics, coroners, and toxicologists, is to construct a "quasi-exhaustive causal list," as inclusive as possible since "the cost of extra length in the causal list is minor, and the gains may be large" (Scriven, 1976, p. 108).

In policy development, the causal list is represented by the set of alternative policies, as exhaustive as possible given the limitations of the analyst and of his information (Lindblom, 1968). As with Scriven's MO, the causal connection is crucial because policies are instruments of social control and sometimes also of social change. The purpose is not "understanding" but "input." The main utility of predictive research, which maximizes the chances of selecting the most appropriate alternative, and hence of implementing successful programs, would be to minimize the social waste represented both by unsuccessful programs and by evaluations of these.

The Policy Process

Keeping in mind this description of policy-relevant research, let us consider the research needs of the four phases of the policy-making process which were identified by Mitchell (1980) and how well these needs are served by traditional social science research and by evaluation research.

Articulation Phase — Enlightenment Function

The role of research findings during the articulation phase is to define and clarify policy problems. This is accomplished by providing “otherwise disparate, unorganized, and potentially conflicting individuals or groups with a common frame of reference or universe of discourse for interpreting a policy problem and identifying proposed solutions” and by influencing “the intellectual conception of a policy problem” (Mitchell, 1980, p. 12).

This function of research findings is derived from Weiss’ description of the utilization of social science research by policy-makers based on three recent studies. She discusses the unifying function of providing a “common language of discourse” (1977a, p. 17), but she emphasizes the indirect, long-term, cumulative effects of social science research findings which are felt in policy-makers’ conceptualizations of the problems and in their understanding of the issues:

Research provides the intellectual background of concepts, orientations, and empirical generalizations that inform policy. As new concepts and data emerge, their gradual cumulative effect can be to change the conventions policy-makers abide by and to reorder the goals and priorities of the practical policy world. (1977b, p. 544)

A second major contribution of social science research generally has been argued by Rist (1981). He maintains that one important function of research is to provide “specific, manageable, and amenable definitions of the issue. If the issue is interpreted as one beyond the range of alternatives open to the policy-maker, response then becomes one of avoiding the issue or placing the blame elsewhere” (p. 487).

Traditional social science research then seems to have two most important contributions to make to the articulation phase of the policy-making process: first, it establishes goals and priorities for policy makers by establishing a common set of concepts and orientations, and second, it helps a great deal in defining and delineating issues with precision.

Oversight Phase: Mobilization of Criticism Function

Evaluation researchers, particularly program evaluators, have come late to the realization that their work has political implications, Sroufe (1977) points out that the paradigms used in the study of politics and those used in evaluation have the effect of keeping the two fields clearly segregated. However, his view is that “formal evaluation is an inherently political process and in some instances it has even greater policy consequences than do board or bond elections” (p. 287).

Evaluators are becoming disillusioned about evaluation and its use. For example, Williams & Evans (1972) conclude

We recognize the danger that the results of evaluation and systematic testing can be ill-used. But what course of action is not dangerous? What “good” approach cannot be turned to evil? Is it not even more hazardous to proceed boldly — as if we know when we do not? . . . As we pose these questions, we trail often to grey areas of nagging doubts, without a burst of penetrating truth. This seems fitting — for to stand unsurely in a morass of conflicting issues simply mirrors the larger reality of today. (p. 264)

In part this disillusionment is a consequence of finding that the political uses of evaluations are almost always negative. Mitchell, in his study of state legislators, found that, although only a minority of policy-makers were active during the oversight phase, those who were active showed an intense desire for

data which provided “clear and unequivocal answers to questions about whether or not a particular program is ‘working’” (1980, p. 1). This is very similar to the function ascribed to evaluation research findings by Wergin (1976) and Williams (1972). It was the legislative actors, not pleased with the program, who displayed this interest in evaluation studies, because they wanted to have convincing evidence to support their negative judgments. Weiss (1973) and Sroufe (1977) have also discussed the utilization of evaluation data to support a particular position concerning the continuation or termination of a program.

Despite all of the current concerns with evaluation and its political significance, the oversight phase of policy making is at least potentially well served by evaluation research which becomes more explicitly political, that is to say, is conducted by evaluators who are clear about the political purposes likely to be served by their work. In particular, policy evaluators need “to note with special attention interests of those parties that will have greatest voice in the policy, and interests of those parties that can directly exert pressure on the controlling parties” (Coleman, 1972b, p. 15).

Aggregation & Allocation Phases: Problem-solving & Evidence Assessment

During the aggregation stage, policy-makers look to research findings as a means of determining the facts and resolving specific issues in the search for feasible policy options. Proponents of particular positions attempt to create a “coalition of support,” one tool at their disposal being the use of research findings to neutralize the objections of opponents and to persuade them of the merits of their position. At this point persuasion can be characterized as an “open give-and-take, collaborative process” (Mitchell, 1980, p. 15), but during the allocation phase there is a shift towards debate winning as commitment to one position strengthens. Consequently the policy-makers must assess the evidence provided by research findings in order to establish probable cause-effect linkages, on which are based predictions concerning the probable outcomes of various policy options, and to use this information as political ammunition to discredit their opponents and to reinforce their supporters. Neither social science nor evaluation research typically fulfill these conditions (see Table 1).

Social science research is addressed to the academic community, and its purpose is to add to the organized body of knowledge of a discipline. This is true both of the naturalistic and the rationalistic paradigms. Such research is not directed towards problem-solving, and Weiss (1977a, 1977b) has argued that it should not be, that the more appropriate role for social science research findings in the policy-making process is that of illumination and enlightenment. Similarly, Cohen and Garet (1975) believe that “research helps to shape policy climates” (p. 25) and “applied research resembles a discourse about social reality — a debate about social problems and their solutions” (p. 42).

Evaluation research, on the other hand, may be considered a type of policy-relevant research, although its role in the policy-making process is quite restricted. It is addressed to policy-makers, and its purpose is to provide data which are “relevant to the judgment of the worth of a social program or its components” (Wergin, 1976, p. 75). Such data may provide important feedback about previous policy decisions. They tend to focus on assessment of the outcomes of a policy decision rather than on the prediction of the consequences of policy proposals, however, and this limits their utility during the aggregation and allocation phases of the policy-making process.

TABLE 1
COMPARISON OF SOCIAL SCIENCE, EVALUATION,
AND POLICY-RELEVANT RESEARCH

CHARACTERISTICS	SOCIAL SCIENCE RESEARCH		EVALUATION RESEARCH		POLICY-RELEVANT RESEARCH
	Naturalistic Paradigm	Rationalistic Paradigm			
intended audience	academic community	academic community	policy-makers		policy-makers
political sensitivity	little or none	little or none	increasing		high
purpose	increase knowledge	increase knowledge	judge program worth		guide policy decisions
function in policy-making process	illumination & enlightenment	illumination & enlightenment	performance evaluation & mobilization of criticism		problem-solving, evidence assessment, and outcome prediction
phase of policy-making process	articulation	articulation	oversight		aggregation & allocation
causality	does <u>x</u> cause <u>y</u> in a natural setting?	does <u>x</u> cause <u>y</u> ?	to what extent did manipulating <u>x</u> cause <u>y</u> ?		how can <u>x</u> be manipulated to cause <u>y</u> under naturally occurring conditions?
setting	natural	laboratory	natural		natural
nature of variables studied	significant in the natural setting	theoretically and/or statistically significant	significant in terms of the goals of the policy being evaluated		contribute to educational outcomes & manipulable by policy-makers
nature of truth statements	context-related "working hypotheses" which focus on exceptions as well as regularities	enduring context-free generalizations which focus on regularities	focuses on discrepancies between goals and outcomes		context-related "working hypotheses" which focus on exceptions as well as regularities
study duration and approach	extended period; formative	generally "one-shot"; summative	generally "one-shot"; summative		longitudinal; formative

Note: Some of the characteristics of social science research, especially the distinctions between the naturalistic and rationalistic paradigms, are based on Guba & Lincoln (1981, p. 57 & 65). Evaluation research can also be either naturalistic or rationalistic.

Thus another form of research is required to serve the needs of the aggregation and allocation phases. The proposed model of policy-relevant research would serve these needs.

The Utility of PRR

The great debate currently in progress, both in the United States and Canada, concerning the utility of social science research in improving public policy has raised a variety of issues. With regard to education, the focus has been on two concerns, (1) increasing the effective utilization of evaluation reports (see, e.g., Alkin, Daillak & White, 1979; Braskamp & Brown, 1980) and (2) political issues. These include the general disenchantment with government intervention, based on a neo-conservative critique (Wirt, 1980); the breakup of the coalition of interest groups which won massive funding increases for education in the 1970s (Guthrie, 1981); and the lack of political sophistication of evaluators (Sroufe, 1977).

No doubt there are major truths in this literature. But some, at least, of the failures of policy research have been implicit in models used in conducting the research. In particular, evaluators come very late to the understanding that "evaluators should adopt a more collaborative role, involving the decision-maker and the staff in decisions about the evaluation" (Dickey, 1980, p. 76). By comparison, program implementers seem far ahead. (See, e.g., the review of research on the implementation of change by Fullan & Pomfret, 1977.)

Throughout this discussion, Policy Relevant Research has been described as an "approach" to research, focusing on prediction, so as to be useful in the policy aggregation and allocation phases rather than in earlier or later phases of the policy process as described by Mitchell (1980). In Table 1, an attempt is made to describe the relationship of PRR to existing research models and paradigms. But it is possible that PRR is itself a research model, independent of others, which contains a characteristic set of variables in stable relationships. These can be verbally summarized thus: the research model assumes complexity, seeks causal relationships in order to make predictions with at least modest levels of probability, and therefore suggests manipulable variables to be used by policy-makers seeking alternative ways of optimizing the attainment of policy objectives. These features can be summarized thus: Policy-Relevant Research

1. *assumes (seeks) complexity*, by carrying out multivariate analyses of data, collected in a variety of ways in naturalistic settings, and by anticipating multiple minor effects on outcomes, rather than a single major cause; and
2. *maximizes causal inquiry* by preferring longitudinal designs using both quantitative and qualitative paradigms and frequently focussing on exceptions rather than norms.

Such research expects to

3. *have utility for policy-makers* by identifying manipulable variables which, within political constraints, assist policy-makers to attain their objectives more efficiently.

The case study and the characteristics of policy-relevant research described here are an attempt to show that a modest shift in approach to conducting policy research could have significant effects. The set of characteristics is probably not exhaustive, and several of these characteristics appear in descriptions of qualitative techniques. However, the approach or model has both utility and integrity: we believe that a review of a broad range of research studies, intended

to be policy-relevant but failing in that intent, would show some deficiency in one of the PRR characteristics which predictably, according to our model, would limit or destroy the utility of the study. We would argue that *all* of the characteristics must be present in some degree.

For example, Williams & Evans (1972) report at length on the Headstart Program and its evaluation, perhaps the best-known and expensive failure in a policy initiative in the history of U.S. education. Yet the evaluation was itself flawed; a subsequent longitudinal study suggests that Headstart was in fact quite successful (Lazar, 1979). Similar illustrations could be provided of failures to take into account, in supposedly policy-relevant discussions, the multivariate nature of relationships in schooling (see e.g., Harnischfeger & Wiley, 1976, and Erickson's critique, 1976), the importance of naturalistic settings, and so on.

Research studies and analyses of existing research findings carried out in accordance with the PRR model are more likely, we believe, to be convincing and useful to policy-makers than the products of traditional research, or evaluation research, conducted according to either the rationalistic or naturalistic paradigms presently in use. However, for this to occur, it is necessary for policy researchers to be much more conscious of the policy development process, and the stage(s) their work is intended to serve. Until modes of research become differentiated, and explicitly purposeful, concerns about the failures of policy-makers to "use" research will continue at their current high level.

Notes

1. We use *policy-relevant* research to denote research serving the aggregation and allocation stages. Coleman (1972b) and others have preempted "policy research" to denote research on the *impact* of policy, i.e., serving the oversight phase.

References

- Alkin, M., Daillak, R., & White, P. *Using evaluations: Does evaluation make a difference?* Beverly Hills, Calif.: Sage, 1979.
- Anderson, J. E. *Public policy-making*. New York: Holt, Rinehart and Winston, 1971.
- Asbury, C. A. Selected factors influencing over- and under-achievement in young school-age children. *Review of Educational Research*, 1974, 44, 409-426.
- Braskamp, L. A., & Brown, R. D. (Eds.), *Utilization of evaluation information*. San Francisco: Jossey-Bass, 1980.
- Bronfenbrenner, U. Is early intervention effective? In M. Guttentag & E. L. Struening (Eds.), *Handbook of evaluation research*, volume 2. Beverly Hills, Calif.: Sage, 1975.
- Cain, C. G., & Hollister, R. G. The methodology of evaluating social action programs. In P. H. Rossi & W. Williams (Eds.), *Evaluating social programs: Theory, practice, and politics*. New York: Seminar Press, 1972.
- Caplan, N., Morrison, A., & Stanbaugh, R. The use of social science knowledge in policy decisions at the national level. Ann Arbor: University of Michigan, 1975.
- Centra, J. A., & Potter, D. A. School and teacher effects: An interrelational model. *Review of Educational Research*, 1980, 50, 273-291.
- Cohen, D. K., & Garet, M. S. Reforming educational policy with applied social research. *Harvard Educational Review*, 1975, 45, 17-43.
- Coleman, J. S. The evaluation of "Equality of educational opportunity." In F. Mosteller & D. P. Moynihan (Eds.), *On equality of educational opportunity*. New York: Vintage Books, 1972. (a)

- Coleman, J. S. *Policy research in the social sciences*. Morristown, N.J.: General Learning Press, 1972. (b)
- Coleman, J. S., Campbell, E. Q., Hobson, C. J., McPartland, J., Mood, A. M., Weinfeld, P. D., & York, R. L. *Equality of educational opportunity*. Washington, D.C.: U.S. Department of Health, Education, and Welfare, U.S. Government Printing Office, 1966.
- Coleman, P., & LaRocque, L. *Secondary schools as viewed by students*. PAC Enterprises, White Rock, British Columbia, April 1981.
- Cook, T. D., & Reichardt, C. S. *Qualitative and quantitative methods in evaluation research*. Beverly Hills, Calif.: Sage, 1979.
- Dickey, B. Utilization of evaluations of small-scale innovative educational projects. *Educational Evaluation and Policy Analysis*, 1980, 2(6), 65-77.
- Egnatoff, J. G. The role of research in policy development: A school board perspective. In *Educational research and policy formation*. Toronto, Ont.: Canadian Education Association, 1978.
- Erickson, D. A. The implications for organizational research of the Harnischfeger and Wiley model. *Curriculum Inquiry*, 1976, 6, 44-66.
- Fullan, M., & Pomfret, A. Research on curriculum instruction and implementation. *Review of Educational Research*, 1977, 47, 335-397.
- Guba, E. G. and Lincoln, Y. *Effective evaluation*. San Francisco, Calif.: Jossey-Bass, 1981.
- Guthrie, J. W. Emerging politics of educational policy. *Educational evaluation and policy analysis*, 1981, 3(3), 75-82.
- Harnischfeger, A., & Wiley, D. The teaching-learning process in elementary schools: A synoptic view. *Curriculum Inquiry*, 1976, 6, 5-63.
- Housego, I. The ideological and the political in policy making. In *Educational research and policy formation*. Toronto, Ont.: Canadian Education Association, 1978.
- Jackson, P. W. *Life in classrooms*. New York: Holt, Rinehart and Winston, 1968.
- Lazar, I. Invest early for later dividends. *The Interstate Compact*, 1979.
- Levin, H. M. A cost-effectiveness analysis of teacher selection. *The Journal of Human Resources*, 1970, 5, 24-33.
- Lindblom, C. E. *The policy making process*. Englewood Cliffs, New Jersey: Prentice-Hall, 1968.
- Mitchell, D. E. Social science impact on legislative decision-making: Process and substance. *Educational Researcher*, 1980, 9(10), 9-19.
- Rich, R. F. Editor's introduction. In R. F. Rich (Ed.), *Translating evaluation into policy*. Beverly Hills, Calif.: Sage, 1979.
- Rist, R. C. On the utility of ethnographic research for the policy process. *Urban Education*, 1981, 15, 485-494.
- Scriven, M. Maximizing the power of causal investigations: The modus operandi method. In Gene V. Glass (Ed.), *Evaluation studies*. Beverly Hills, Calif.: Sage, 1976.
- Smedley, R. H., & Olsen, G. H. *Graduate follow-up studies: How useful are they?* Paper presented to the Annual Meeting of the American Educational Researchers Association, Washington, D.C., 1975. (Ed 109431)
- Sroufe, G. E. Evaluation and politics. In J. D. Scribner (Ed.), *The politics of education*. Chicago, Ill.: The University of Chicago Press, 1977.
- Weiss, C. H. The politics of impact measurement. *Policy Studies Journal*, 1973, 1(3), 79-83.
- Weiss, C. H. (Ed.). *Using social research in public policy-making*. Lexington, Mass.: Lexington Books, 1977. (a).
- Weiss, C. H. Research for policy's sake: The enlightenment function of social research. *Policy Analysis*, 1977, 3, 531-546. (b)

- Wergin, J. F. The evaluation of organizational policy-making: A political model. *Review of Educational Research*, 1976, 46, 75-115.
- Wilder, G. Five exemplary reading programs. In J. T. Guthrie (Ed.), *Cognition, curriculum, and comprehension*. Newark, N.J.: International Reading Association, 1977.
- Williams, W. The organization of the volume and some key definitions. In P. H. Ross, & W. Williams (Eds.), *Evaluating social programs: Theory, practice, and politics*. New York: Seminar Press, 1972.
- Williams, W., & Evans, J. W. The politics of evaluation: The case of head start. In P. H. Ross & W. Williams (Eds.), *Evaluating social programs: Theory, practice, and politics*. New York: Seminar Press, 1972.
- Wirt, F. M. Neoconservatism and national school policy. *Educational Evaluation and Policy Analysis*. 1980, 2(6), 5-18.
- Wolcott, H. *The man in the principal's office: An ethnography*. New York: Holt, Rinehart and Winston, 1973.

BOOK REVIEW

CRITICAL THINKING AND EDUCATION. By John E. McPeck. Toronto: Oxford University Press, 1981, 170 pp.

Much of the writing that passes for Philosophy today might bring to mind the conversation between Alice and Humpty Dumpty in Lewis Carroll's *Through the Looking Glass*.

"When I use a word," Humpty Dumpty said, in rather a scornful tone, "it means just what I choose it to mean neither more nor less."

"The question is," said Alice, "whether you can make words mean so many different things."

"The question is," said Humpty Dumpty, "which is to be master — that's all."

The endless and often tedious quibbling about the meaning of individual words or phrases is the main preoccupation of much Philosophical Analysis. John McPeck's *Critical Thinking and Education* is in some ways reminiscent of the conversation cited above, but in McPeck there are some very noticeable differences. Roughly one-half of John McPeck's *Critical Thinking and Education* is devoted to showing how the definitions of Critical Thinking offered by other philosophers are either inadequate or flatly wrong. However McPeck's book is a very rare and powerful example of why this process is both necessary and at times extremely useful.

McPeck has written a short yet highly informative and provocative book on the nature of critical thinking and its place in the process of education. This book is worthwhile and enjoyable to read because it actually advances the reader's understanding of the term critical thinking while offering strong evidence for the validity and usefulness of philosophical analysis as a legitimate approach to educational problems.

The strength of McPeck's position is to be found in his definition of critical thinking and the way in which it differs from others that are presently in use. Critical Thinking is, for McPeck, "the propensity and skill to engage in an activity with reflective skepticism" (p. 8). At first glance this appears to be a disarmingly simple straightforward definition of this term but, as McPeck's book indicates, it is a very complex term which is widely misunderstood.

Unlike many other analytical philosophers, McPeck does not view critical thinking as a set of skills or the ability to detect logical inconsistencies in propositional statements. He convincingly argues that critical thinking cannot be taught apart from specific subject matter. McPeck's position is that critical thinking can only be demonstrated in reference to a particular subject.

The analysis of critical thinking provided here make it abundantly clear that it can only be taught as part of a specific subject and never in isolation. Indeed the very idea of teaching critical thinking in isolation from specific content is incoherent. (p. 158)

There are many courses taught in universities and faculties of education in particular which claim to teach students to think critically, but for McPeck these types of claims are essentially fallacious for they are based upon a false notion of what critical thinking is. Becoming a critical thinker is not simply learning to utilize the tools of logic or verify or analyze statements that are made. Rather, critical thought becomes a possibility only after the individual has mastered the basic or foundational ideas of a particular subject. He or she is then in a position to think critically about a particular subject because the individual knows the subject matter well enough to affirm or deny the validity of the basic assumptions that constitute that particular subject. Critical thought, for McPeck, is based upon and is an extension out of a solid knowledge of a particular set of ideas or concepts. We cannot, for McPeck, think critically until we can think clearly but he does not reduce clear thought to the tricks of logic or the capacity to detect inconsistency in an argument. What is essential for critical thought is grounded knowledge. The lack of extensive knowledge of a particular subject will for McPeck preclude the possibility of an individual developing or utilizing critical thought in reference to that subject. In a statement which, taken at face value, would sound the death knell for many critical thinking courses presently offered in faculties of education, McPeck argues that in reflecting and then making decisions about

real public questions it is usually not the logical validity of an argument that we find difficult but rather the task of determining whether certain premises are in fact true. (p. 25)

McPeck goes on to show through a series of simple yet forceful examples how the presence or absence of concrete specific knowledge of a subject is most often the impediment to the realization of a solution. This is not to suggest that logic is irrelevant to the numerous problems that we encounter both inside and outside the educational process. Most often, however, it is not the logical status of the argument or set of propositions that represents the major problem for us; it is, rather, determining the truthfulness or validity of the evidence that is offered. The only means for resolving this dilemma is to be very knowledgeable about the subject under consideration. For McPeck, an individual could be very, very logical in reference to a particular problem or statement but, if that individual were lacking in knowledge of the subject out of which the problem or statement arises, then the possibility of critical thought being expressed is either slim or nonexistent. McPeck shows that critical thinking is much more rightfully the province of subject matter specialists than of those who are well trained in the use of logic or logical analysis.

McPeck has performed a very real service in showing how many philosophers and educators have misunderstood the concept of critical thinking. The only apparent shortcoming of McPeck's book is that it offers no specific or even tentative ideas for how the school system or educators might realize the conditions necessary for the exercise of critical thinking. McPeck is silent on the issue of how a system or individual teacher can bring students to mastery of subject matter so that they can begin to demonstrate critical thinking abilities. That, of course, is a very large complex issue which McPeck, perhaps wisely, avoids. It would have

been useful to have a man of his intelligence and insight try the more basic problem in the quest for critical thought. Regardless, McPeck's clarification of the term, critical thinking, represents an impressive and notable achievement.

David Wangler
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For further information contact: Dr. Anne L. Jefferson or Professor Elva Motheral, Faculty of Education, University of Manitoba, Winnipeg, Manitoba, R3T 2N2.

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A NOTE ON THE EDITORSHIP

The Publications committee extends sincere thanks to Dr. Doyal Nelson who has completed his term as Editor of AJER. We take this opportunity to acknowledge the significant contribution which he made to the continued development of AJER under the particularly challenging circumstances which have confronted scholarly publications in recent years.

With the publication of this issue we welcome Dr. Chester S. Bumbarger as the new Editor. Prior to joining the University of Alberta in 1967, Dr. Bumbarger was with the Bureau of Educational Research and Service at the University of Oregon. He holds M.Ed. and D.Ed. degrees from the University of Oregon. His professional background includes teaching and administrative experience at the school and university levels in Oregon, as well as a period of service in the State Department of Education.

Dr. Bumbarger's main teaching and research interests are in the areas of educational planning and organization theory. Included among his recent research involvements are studies of school finance and the evaluation of inmate education programs. He is currently Chairman of the Department of Educational Administration.

In addition to previous editorial experience as Editor of *The Canadian Administrator* and an Associate Editor of *Educational Administration Abstracts*, Dr. Bumbarger has served on the Editorial Board of *Challenge* and on the Research Review Panel for the journal of the Council of Educational Facility Planners.

The Publications Committee looks forward to working with Dr. Bumbarger. We wish him every success in his new responsibilities, and we hope that he will find them both professionally stimulating and rewarding.

E. Miklos, Chairman
Faculty Publications Committee

Editor's Message

The relevance of AJER to its readers depends in large part on manuscript assessments provided by specialists in the various fields of education. Such assessments are requested and provided with no compensation to those making the assessment. I wish to use this page to acknowledge assistance given to AJER this past year by the following:

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AKIRA KOBASIGAWA

University of Windsor

Children's Retrieval Skills for School Learning

Children from grades 4 and 8 were interviewed to assess their retrieval skills typically required for conducting research projects in school. One aspect of the study was concerned with children's skills in selecting search areas or specific sections of a book for a particular retrieval question by using relevant knowledge. Younger children had the relevant knowledge for the retrieval question but used that knowledge to define search areas only when highly directive instructions were given, whereas older children did so with fewer prompts. Another aspect of the study was concerned with children's disposition to evaluate gathered information against some criteria. Grade 4 children were less sensitive than grade 8 children to the need to evaluate collected information according to task demands, although many of them could be induced to think in this direction.

In the recent literature on cognitive development, there has been a growing interest in children's awareness of various reading-study techniques. Brown and Smiley (1977; 1978), for example, examined students' abilities to detect the essential elements of texts and their disposition to focus on such crucial units during study to improve subsequent recall. Myers and Paris (1978) investigated children's ideas about specific capabilities required for efficient reading, the nature of materials affecting reading processes, and strategies to overcome comprehension failures. More recently, Kobasigawa, Ransom and Holland (1980) observed children's strategic behaviors for locating specific pieces of information in prose passages. The findings reported by these investigators suggest that, during the elementary school years (grades 1 through 8), children become better aware of the existence of various study strategies and more sensitive to when and how to use them.

The present study was designed to explore further the development of study techniques with particular focus on retrieval strategies that are typically required for conducting research projects in elementary school. Assigning research projects to children of mid-elementary grade level (grade 4) has become one widely accepted method of teaching (e.g., Hooper & Dalton, 1973). Also, experts on reading-study techniques have emphasized the importance of retrieval skills in school learning (Thomas & Robinson, 1975; Thorn, Braun & Richmond, 1974). Since new

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information is being discovered and accumulated at an accelerating rate in today's world, a single classroom textbook can no longer be regarded as a sufficient and up-to-date source of information for most content areas (e.g., social studies). Students' success in school learning, therefore, is increasingly more dependent on their knowledge about where and how to locate new information efficiently (Thomas & Robinson, 1975). Consequently, the present study should provide useful data for our understanding of the development of "ecologically valid" study strategies in children.

The selection of specific aspects of retrieval processes for the present investigation was guided by previous conceptualizations of memory search (e.g., Flavell & Wellman, 1977; Kobasigawa, 1977; Shiffrin, 1970) and experts' opinion on study skills for elementary school children (e.g., Hooper & Dalton, 1973; Thorn, Braun & Richmond, 1974). On the basis of such models, we will briefly describe a framework of retrieval processes to clarify the focus of our research problem.

Retrieval processes begin when children generate or are given questions for their research projects and end when they formulate final answers to such questions (Kobasigawa, 1977; Shiffrin, 1970). With this definition, the retrieval processes may be divided into two interrelated subprocesses: (a) a search process, in which a person attempts to determine where the desired information is likely to be located and (b) an evaluation process, in which the suitability and sufficiency of gathered information for retrieval questions are determined.

With respect to the search process, imagine that one day children are learning various facts about China (e.g., China is the third largest country. Many people work on farms. China cannot produce enough food to feed its people.). At this point, students may be asked to do research projects to find out additional information about China (e.g., China: Farming in China. Climate in China). Children select research topics, locate several books on China, and determine if a particular book contains the sought-for information by consulting the table of contents and/or index as aids. The search process is relatively simple and straightforward if retrieval questions contain explicit "key words" that children should look for in the table of contents (e.g., "Find out about *farming*"). The search process, however, may become difficult when questions do not indicate explicitly what specific chapters or section of a book they should look for, for example, "Why cannot they produce enough food even though many people work on farms?" Based on the retrieval question, children may realize that answers may be found in a section of a book on "farming." Using their general knowledge that climatic conditions are important factors for farming, some of the children may additionally reason that a section on "climate" may contain answers to the question. To select search areas (chapters of a book), the second type of retrieval questions requires, as Flavell and Wellman (1977) have characterized a mature retriever, skills to integrate information given in a retrieval task, general knowledge, and reasoning. In the present study, we were interested in the development of such skills in children.

The information gathered through the search process may not automatically be included in a final report, but needs to be evaluated according to such criteria as relevancy and accuracy (e.g., Shiffrin, 1970; Thorn, Braun & Richmond, 1974). Even when students have collected several pieces of relevant-looking information, considering the task demand (e.g., I need the most recent information.), they need to decide which one of them best contributes to the solution of their problem.

With respect to the evaluation process, therefore, we assessed children's sensitivity to the need for evaluating the suitability of gathered information with regard to the purpose of the projects: Do I have enough relevant information? Do I have irrelevant information? Is this information up-to-date?

The specific purpose of the present investigation was, then, to provide developmental evidence for the acquisition of skills to select search areas and to evaluate gathered information. In addition, data concerning types of research questions children generate were also obtained. Towards this end, children of grades 4 and 8 were presented with a series of interview items. Grade 4 was selected as the youngest age group because children at that grade level begin independent research in school. The interview items included both relatively unstructured and structured forms of questions in order to describe a clearer picture of age-related differences in the use of retrieval skills. Also, to demonstrate the replicability of the present data, findings from our initial investigation (Kobasigawa & Barnett, 1981) will be provided.

Method

Subjects

Subjects were 20 grade 4 (\bar{X} CA = 9.8 years) and 20 grade 8 (\bar{X} CA = 13.8 years) children, balanced within each grade for sex. These children were drawn from a predominantly middle class parochial school located in the outskirts of Windsor, Ontario. Subjects for our preliminary study also consisted of 20 grade 4 and 20 grade 8 children with comparable chronological ages and were drawn from one parochial school in Windsor City, Ontario. According to their teachers' judgments, none of these children should have had difficulty in reading the materials used in this study. All of the participants had done research projects prior to participating in this study. Children were familiar with the card catalogue in the school library and the use of a table of contents and index for answering simple retrieval questions, for example, "Find out about spiders" (Hooper & Dalton, 1973, 99-100).¹

Materials

Six sets of interview items, each consisting of different numbers of questions, were prepared. These items were designed to assess children's skills to generate research questions, select search areas (chapters) in a particular book, and to evaluate the retrieved information regarding its suitability and accuracy. To facilitate communication of the findings, the interview questions and their intended foci will be described in detail in the Results section.

In addition to the interview items, the following materials were also prepared: (a) a map of Asia showing the location of China and a short prose passage about China (based on Butterfield's article, 1979) from which children were asked to generate research questions; (b) a sheet of paper on which a contents page of a particular book was shown; (c) a hand-written brief report in which two pieces of target information were missing while unrelated information was included; and (d) a world map indicating the distribution of certain animals and three "author cards" including call numbers of books, titles of the books, publishers' names, and dates of publication. Research topics included in the interview items were about "countries" and "animals." These topics were selected because, according to research coordinators of the school systems, they represented the most popular research topics for school children.

Procedure

The children were interviewed individually in a quiet room at their school. After briefly establishing rapport with the children, the interviewer explained that she would be asking questions about how children would go about doing their research projects at school. It was emphasized that the children were required simply to try "your best to say what you think." The interview items were presented in the same order (in the order as seen in Results) for all of the children. If children were unable to answer or clearly misunderstood a question, it was repeated or rephrased. Although children's verbal responses were tape-recorded, most of the responses were recorded on data sheets during the interview by the interviewer as the present tasks generally required simple answers from the children.

Scoring

Based on the intended focus of the questions and preliminary investigation of the verbal data, categories were generated to classify children's responses to each interview question. When children were allowed multiple responses, they could be credited with several categories. Using these categories, two judges independently scored the responses for each of the protocols. Interjudge reliability for each question was obtained by dividing the number of instances in which judges agreed on the use of the particular categories by the sum of agreements plus disagreements on the use of categories. Interjudge reliability scores for various questions ranged from 96% (classification of responses to "why" of Item 3-b) to 100% (Item 1, Item 2-c, Item 4). Disagreements that occurred in the scoring were reviewed and resolved by obtaining a consensus between the judges. Reliability was not assessed for those questions requiring Yes-No answers or simple choice responses for which agreement was obvious.

Results

Age differences within all response categories were analyzed by forming 2 (grades 4 vs. 8) \times 2 (a particular response presence vs. absence) tables. Then Mainland and Murray's (1959) fourfold contingency tables were applied to the data. Mainland and Murray's tables substitute for direct computation of Yates' correction or Fisher's exact probabilities. For this reasons, only *p* values will be reported.

Generating Research Questions

The first interview item was prepared to determine what kinds of research topics or questions children generate by themselves. Of particular interest was whether or not children would suggest the kind of the retrieval question that we used for the second interview item (see Item 2).

1. "Let's pretend that one day in school you learned these things about China (the *E* gave a short prose passage to *S*). 'China is the third largest country in the world. Only Canada and Russia are bigger than China. Most of the people in China work on farms. But China cannot produce enough food to feed its people. Many people in China still are hungry.' Then the teacher tells you to do a research project about what you learned about China on that day. What kinds of topics or questions can you pick for your project from what you just learned?"

In general, the purpose of doing research projects is to clarify ambiguous information given in textbooks or to obtain related new information. As a result, children’s research questions were classified into (a) a “known” category if answers to the questions were already given in the material (e.g., “What’s the third largest country?”) and (b) an “unknown” category if children’s questions were to obtain new information. The unknown category was further divided into two types: a “single-fact seeking” type (e.g., “How big is China?” “What’s the population of China?”) and an “open-ended” type where questions were broad enough to write research projects or produced further questions (e.g., “Farming in China.” “What do they bring to feed people? What are others doing to help them?” “How come they can’t produce enough food?”).

TABLE 1
VARIOUS TYPES OF RESEARCH QUESTIONS GENERATED BY CHILDREN

	Known	Unknown	
		Single Fact	Open Ended
Grade 4	5 (5)	4 (4)	1 (1)
Grade 8	2 (1)	3 (4)	15 (15)

Note. When children's responses included different types of questions, they were classified using the questions of higher levels. For example, children generating a single fact seeking and an open ended questions were classified into the open ended category. Figures in parentheses are based on the Kobasigawa and Barnett study (1981).

The findings are summarized in Table 1. One-half of the grade 4 ($N=10$) but all of the grade 8 children ($N=20$) generated at least one research topic or question. The remaining half of the grade 4 children repeated the reading material (e.g., “China is the third largest country.”). A comparison across grades of the number of children who generated topics with those who did not yielded significant differences, $p<.01$. Significantly more of the grade 8 than the grade 4 children suggested the “unknown” type (5 vs. 18) or “open-ended” type (1 vs. 15) questions, $p<.05$. These age-related trends are comparable to those obtained in our preliminary study (Kobasigawa & Barnett, 1981), also summarized in Table 1 (figures in parentheses). As can be expected from these data, more of the grade 8 ($N=8$) than grade 4 ($N=1$) children spontaneously generated the retrieval question that we used for item 2 (“Why can’t China produce enough food?”).

Selecting Search Areas

Imagine now that children have selected their research topic and have located several books with titles that bear upon their problem. How will they proceed to check whether or not each book is likely to include the desired information? Assuming that a majority of children will say that they will use a table of contents and/or index, what specific topics or key words (i.e., search areas) do they look for in such book parts? To examine these questions, children were presented with Item 2.

2. "One child in the class, Jack,² said, 'I want to find out why China cannot produce enough food even when many people are working on farms.'³ (A card containing Jack's research question was given to the child.) Jack found several books on China. (a) How can he quickly find out what topics are in the first book? What parts of the book should he look in? (b) What (key) words should he look up in the index? What chapters should he look in to answer the question? (c) Can you make a guess why China cannot produce enough food?" Children were frequently reminded of Jack's research question.

For question *a*, 80% of the grade 4 and all of the grade 8 children said "index," "table of contents," or both. These findings were consistent with those observed in our preliminary study (Kobasigawa & Barnett, 1981). The remaining 20% of the grade 4 children said "I don't know," although they were aware where they could find the content pages and index in a book.

For question *b*, many of the grade 4 children (60%) initially said that they would look for the word "China" in the index. These children were reminded that the whole book was about China and asked to generate additional key words or topics. Forty percent of the grade 4 but all of the grade 8 children suggested at least one topic or key word. This age-related difference was statistically reliable, $p < .01$. Grade 4 children's topic words were restricted to "farming" and "food,"⁴ both of which appeared in the retrieval question. In contrast, about one-third of the grade 8 children indicated that they would also use such additional key words as "population," "climate," "weather," "soil," "land," and "industry." Apparently, some of the grade 8 students used their general knowledge (e.g., the rapid growth of population affects the sufficiency of food) to specify what sections of a book (population) other than "farming" might contain the target information. Although many children probably did not think about using their related knowledge to generate these "implicit" key words, they may be able to do so if they are prompted to think in this direction. To determine this possibility, question *c*, "Can you make a guess why China cannot produce enough food?" was asked.

None of the children indicated that they knew why people in China cannot produce enough food and, consequently, their responses to question *c* may be regarded as their hypothesis constructed during the interview. When children's hypotheses included any factor affecting the production of food, they were regarded "adequate" as long as they did not contradict information provided in the present task. For example, "maybe they don't have farmers" was not classified as "adequate" because the retrieval question states that "many people work on farms." Fifteen percent of the grade 4 and 60% of the grade 8 children generated at least one hypothesis, including "too many people in China," "the climate is not suitable for farming," "the condition of the land is not adequate for farming," and "they don't have good seeds." The observed age-related trend was statistically significant, $p < .05$.

Children's responses to questions *b* and *c* of Item 2 indicate that a considerable proportion of the grade 4 children does not use general knowledge to limit search areas. The younger children's relevant knowledge, however, may become more accessible for use to define search space if the situation is made more concrete by providing them with examples of possible search areas (i.e., a table of contents). In light of these considerations, the following questions were asked.

3. After reminding the children of Jack's topic, the interviewer said: "In the first book, Jack finds this page (the *E* showed *S* the contents page of the first book.). (a)

Do you think that this book is useful for Jack’s project? Why or why not? (b) Jack wants to use this book. Which chapter should Jack read first? Why? If Jack doesn’t have time to read the whole book, what are two more chapters that he should read for his project? Why?” The specific chapters appear in Table 2.

As to question *a*, 85% of the grade 4 and all of the grade 8 students affirmed the usefulness of the book for Jack’s project; 15% of the grade 4 children said “I don’t know.” Of those children who said the book would be useful, 16 of 17 grade 4 and all of the grade 8 children explained their decision by referring to at least one of the following four chapters: Farming, Land, Climate, and History. As one might expect, “Farming” was the most popular choice; 94% of the grade 4 and 85% of the grade 8 students selected this chapter. There were no significant age-related differences in children’s responses reported thus far. The older children, however, justified their decision that the book was useful by referring to a larger number of chapters (\bar{X} =2.3, N =20) than did the younger children (\bar{X} =1.2, N =17), $F(1,35) = 15.22, p<.001$. It appears that older children are more likely than younger children to consider “implicit” questions (e.g., Is the climate in China suitable for farming?) associated with the retrieval question and, consequently, recognize the relevance of more chapters. We found, though, that both younger and older groups responded in a similar manner when they were explicitly asked to choose three relevant chapters (question *b*).

TABLE 2
NUMBER OF CHILDREN SELECTING VARIOUS CHAPTERS
AS RELEVANT FOR ITEM 3-b

	Intro.	History	Land	Climate	Educ.	Cities	Farming	Arts	Sports
Grade 4	4	9	13	8	3	3	19	1	0
Grade 8	1	8	16	13	1	1	20	0	0
Grade 4	0	8	14	11	3	4	20	0	0
Grade 8	5	3	19	12	1	1	19	0	0

Note. Each child selected 3 chapters. The data summarized in the lower half of the table are based on the Kobasigawa and Barnett study (1981).

Children’s answers to question *b* are summarized in the upper half of Table 2. As can be seen in the table, most of the responses (88%) are restricted to the four chapters: Farming, Land, Climate, and History. Within each of these response categories, significant age-related differences were not observed. Once provided with an outline of the contents of a book, many of the grade 4 children were able to interpret the present retrieval question (i.e., they could figure out what search areas they should look for) in a manner comparable to the grade 8 children and thus selected similar “search areas,” although previously these children rarely generated this type of research question spontaneously (see item 1) or search areas other than

“farming” (see Item 2 *b* and *c*). Seventy-five percent of the grade 4 and 90% of the grade 8 children selected either “climate,” “land,” or both, and explained why the chapters they selected might contain possible answers to the research question (“Climate, if they don’t have the proper weather, nothing will grow.”). This finding suggests that the general knowledge that climatic conditions are important factors for farming is available even for many of the younger children, although that relevant information appears to become accessible for use only under the highly structured task situation. Children’s responses to question *b* of Item 3 summarized here are consistent with those obtained in our preliminary study (Kobasigawa & Barnett, 1981). The data for the previous study are presented in the lower half of Table 2.

Evaluating Gathered Information

With Items 4 and 5, we investigated whether or not children would show awareness that the suitability of collected information needs to be evaluated against retrieval questions (Do I have enough relevant information? Do I have unrelated information?).

4. “Jenny was told by her teacher to find answers for these three questions using an encyclopedia. (The *E* gave *S* a card containing the three questions.) A. Where do black bears live? B. How heavy are they? C. How fast can they run? Jenny thinks that she has finished her report and shows it to you. (The *E* gave Jenny’s report to *S*.) Does the report look OK? Why or why not?” Jenny’s report began by stating its purposes to answer three questions, continued with an answer to question A, a very general statement regarding question B (“Black bears are the smallest bears of North America.”), but did not have any information for question C. It also included three sentences unrelated to the questions (e.g., “They like sweet things.”).

TABLE 3
NUMBER OF CHILDREN SHOWING VARIOUS RESPONSES TO ITEM 4

Acceptable		Unacceptable		
		Relevant Information Missing	Delete Irrelevant Information	Other Reasons
Grade 4	12	5 (3)	0	3
Grade 8	3	16 (14)	1	0
Grade 4	12	8 (4)	0	0
Grade 8	2	17 (15)	3	0

Note. A child can be classified into both "relevant information missing" and "delete irrelevant information" categories. For example, "He did not answer questions B and C. I don't think he needs these sentences (irrelevant information)." The figures in parentheses represent the number of children who said answers for both questions B and C were missing. The data summarized in the lower half of the table are based on the Kobasigawa and Barnett (1981) study.

Children's responses are summarized in the upper half of Table 3. The trend for the younger children to say "Yes, the report looks fine" (60%) and for the older children to say "No" (85%) was statistically reliable, $p < .01$. "Everything is true" and "There is nothing wrong with the spelling" were two major reasons given by the children for accepting the report. Significantly more of the grade 8 (80%) than the grade 4 (25%) children specifically indicated that at least one piece of relevant information was missing, $p < .01$. As is shown in Table 3, most of the children were more concerned with the missing information than with the irrelevant information; even the older students rarely mentioned the need to delete the unrelated sentences. These findings replicated what we observed in the Kobasigawa and Barnett study. The results of the latter study are summarized in the lower half of Table 3. In the next set of questions, we explicitly indicated to the children that Jenny's report was unsatisfactory to assess the lower limits of the children's awareness of criteria to evaluate the gathered information.

5. "The teacher is unhappy with the report and tells Jenny to work on it some more. (a) Is there any more information that Jenny should put into her report? (b) Is there any information that Jenny should take out of her report? (c) In Jenny's report, do you find an answer for question A? Do you find an answer for question B? Question C?"

With question *a*, the age-related difference observed for Item 4 was reduced slightly, but continued to be significant, $p < .05$; 45% of the grade 4 and 90% of the grade 8 children said that relevant information for question B or C was missing in Jenny's report. While this finding suggests that many of the grade 4 children are not sensitive to the need to evaluate the collected information against the retrieval questions, the generalizability of this conclusion may be limited. Kobasigawa and Barnett (1981) reported that, when question *a* was given, 70% of the grade 4 students indicated that Jenny's report did not contain information for question B or C. With question B, there were more children who indicated that unrelated information should be excluded from the report than when given Item 4; 35% of the grade 4 and 75% of the grade 8 children pointed out at least one unrelated sentence included in the report, $p < .05$. In the Kobasigawa and Barnett study, 50% of the grade 4 and 60% of the grade 8 students identified at least one unrelated sentence. Finally, with question *c*, practically all of the children, just as was found in our preliminary study, realized that Jenny's report did not include answers for question B and C. This final finding suggests that grade 4 children have the ability to recognize what constitute appropriate answers to the present retrieval questions, although they frequently do not use that ability to evaluate the gathered information (Item 4; Item 5 *a*).

6. Item 6 was prepared to assess children's awareness of the importance of checking whether or not located information is up-to-date. "Neal and his friends are doing a project on where wolves live today. They have learned that *wolves are disappearing from different parts of the world* (the italicized part was emphasized). They want to make a map showing where wolves live today. (The *E* showed the *S* a map illustrating the distribution of certain animals.) When they looked at the card catalogue of the library, they found three books, each book with a map showing where wolves live. (The *E* gave *S* three author cards and read the author's name, the title of the book, and its publication date written on each card). (a) If they can choose only one book, which book should they pick for their project? Why? (b) Is it important to check when the book was published?

Children's responses to "why?" (question *a*) indicated that 70% of the grade 4 and 50% of the grade 8 children selected material using only the title of the book as criterion ("This book would be the best 'cause it says 'Where are wolves?' " "This one would be OK 'cause it says 'The kingdom of wolves' "). The remaining children said that they should choose the book with the most recent publication date. This observed age-related difference was not statistically reliable. When children were further asked whether or not they should have thought about the publication date for the selection of information source (question *b*), 60% of the grade 4 and 95% of the grade 8 children recognized the importance of the "up-to-date" criterion (e.g., "I didn't think of the date. Many wolves could be extinct and there could be new information on where they live now."). A comparison of "title" with "up-to-date information" categories yielded significant age differences, $p < .05$. A similar age-related trend was observed in the Kobasigawa and Barnett study; 95% of the grade 4 and 40% of the grade 8 children did not use the "recency" criterion for selecting the information source (question *a*).

Discussion

One aspect of the present study was concerned with children's skills in selecting search areas by using information given in a retrieval question and their related knowledge. When asked explicitly to choose the three most relevant chapters for the present retrieval question (Why can't China produce enough food?), younger students responded similarly to older students, selecting such chapters as Farming, Climate, and Land (Item 3-b). Furthermore, grade 4 children frequently explained why those chapters selected might contain possible answers to the retrieval question. Grade 8 students, however, were able to narrow the search area with fewer directive instructions than did grade 4 students. These findings suggest that many younger children have the relevant knowledge for the present retrieval question but use that knowledge to define search areas only under highly structured situations, whereas older children can use that knowledge more widely.

Several speculations can be made with regard to the age-related differences just noted. Firstly, although not all of the grade 8 students were mature retrievers (i.e., they needed a few prompts to generate search areas), more of the older than younger children are planful to devise strategies to limit search space. One step in the process of restricting the search space for the present retrieval question is to search for related knowledge: Have I seen or studied analogous problems? What were factors affecting the sufficient production of food in those problems? Are such factors applicable to the present retrieval problem? etc. (e.g., Collins, 1977; Wessels, 1982). One of the grade 8 students spontaneously illustrated such thinking processes: "I don't know about China. But I learned that people in India had the same problem. Maybe there are too many people in China." Secondly, while both younger and older children may know that certain factors affect effective farming, that knowledge may change with age; older children's knowledge may become more elaborate as it is integrated with additional pieces of information or specific instances and, consequently, it may become readily accessible under wider situations (Flavell, 1977). Thirdly, there is evidence from teachers' curriculum guide books (e.g., Hooper & Dalton, 1973) and from our informal interview with teachers, that teachers are likely to assign well-defined research questions to younger children (e.g., "Find out about spiders."). When retrieval questions are simple, soliciting a few pieces of factual information, there is no need

to subject these questions to further analyses to facilitate the search process. In contrast, it is reasonable to assume that older children receive relatively more complex research topics that require identifying specific components. Presumably, any combination of these factors (older children's planfulness, their elaborate and accessible knowledge, and increased experiences with ill-defined problems) facilitates older children's spontaneity for reducing search space observed in this study.

A few comments will be made on children's skills to use book parts. According to standardized tests on study skills (e.g., King, 1968), knowledge about the use of book parts is expected to be achieved by the grade 4 level. Standardized test items generally contain explicit key words that are highly salient targets for search in a table of contents or index. (e.g., "Do we find a botanical garden in San Francisco?" "Chapter 3: Where botanical gardens are.") In contrast to such items, the present retrieval problem required children to generate what might constitute key words (climate, land) when selecting appropriate chapters. The results of this study (Item 2-a; Table 2) suggest, then, that many children, by the time they finish grade 4, can learn when and how to use book parts efficiently as guides to locate information beyond the level generally required by standardized tests. Beyond the grade 8 level, as some of the grade 8 students demonstrated, children's use of the table of contents may become much more systematic in the order they select chapters: First, you should find out what they are trying to grow (chapter on farming). Then you check if the soil is suitable for what they are trying to grow (chapter on land). If the soil is dry, you check if the climate is dry (chapter on climate).

The second aspect of the present study dealt with children's awareness of criteria by which to evaluate collected materials. In one related item, the majority of the grade 4 children selected a reference book without checking its recency of publication, although the research question obviously implied that the up-to-date information was required (Item 6). When they were asked to evaluate a hypothetical report containing incomplete answers to retrieval questions, more grade 4 than grade 8 children failed to recognize that the report lacked sufficient relevant information (Item 4). Younger children's tendency to overlook incomplete answers may be attributable to two reasons. First, to decide whether or not a report (or a piece of reference material) contains the requested information, children must continuously attend to several specific purposes of the essay while simultaneously reading its contents. Perhaps this is a difficult cognitive operation for some of the younger children to carry out spontaneously, although they exhibit such skills when assisted by an adult in considering each purpose separately ("Do you find an answer for question A?" Item 5c). Alternatively or additionally, younger children may have a different or a more dominant criterion for evaluating gathered information than that necessitated by the retrieval questions. For them, as was indicated by some of them, to evaluate a report means to check mainly whether or not each piece of retrieved information is empirically true or if an essay is neatly written (similar results are reported by Markman, 1979). For either case, the present findings (Items 4, 5 and 6) suggest that younger children are less sensitive than older children to the need to evaluate collected information and reference materials according to task demands.

Previous researchers (Thomas & Robinson, 1975) have reported that children frequently waste their time by presenting task irrelevant information in their

reports. Interestingly, this observation appears to apply not only to grade 4 but also to grade 8 students in this study (see Table 3). Of course, this finding could partly be due to the fact that children were not instructed to point out exhaustively the inadequacy of the gathered information. Having considered that the identification of a few pieces of missing information would be sufficient for the present task demand, some of the older children might have simply terminated a search for additional problems involved in the report.⁵ Approximately 30% of the older children, however, still did not mention the presence of irrelevant information in the report even when it was hinted they think in this manner (Item 5 question b). Informal evidence obtained from verbal reports of several children suggests that this observed tendency to "include all" may not always reflect their inability to detect irrelevancy of information but the use of a different criterion that "you'll get a better mark if you write more."

In summary, both the present and our preliminary studies provided evidence that, during the upper-level of elementary school years, children become increasingly more skillful at such aspects of the retrieval process as generating and defining search areas and evaluating gathered information and its sources. It has been suggested that children's sensitivity to the need to use such strategies depends to a great extent on the complexity of the retrieval problems, the difficulty level of the reading materials, and the nature of the task demands (e.g., Brown & Smiley, 1978; Kobasigawa et al., 1980). Accordingly, we may question just what kinds of retrieval tasks are required for younger children to become aware of the importance of thinking about related knowledge to specify search space. How well can older children narrow down research topics if such topics exceed the complexity of those used in the present study? We asked the children in this study to solve hypothetical research problems; yet, to what extent do children spontaneously think about and use retrieval strategies assessed here while they actually undertake research projects at school? Future studies to resolve these and other related issues would seem a worthwhile research endeavour.

Notes

1. Hooper and Dalton's Teacher's guidebook is used by the teachers of the schools where the present and preliminary studies were conducted.
2. A female name was used for girls. This note applies to the remaining items.
3. This retrieval question was suggested by Wiens (1966).
4. As comparable key words to "farming" and "food," a few grade 8 students suggested "agricultural products" and "crops."
5. This point was suggested by one of the reviewers.

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References

- Brown, A. L., & Smiley, S. S. Rating the importance of structural units of prose passages: A problem of metacognitive development. *Child Development*, 1977, 48, 1-8.
- Brown, A. L., & Smiley, S. S. The development of strategies for studying texts. *Child Development*, 1978, 49, 1076-1088.

- Butterfield, F. China. In *Collier's year book: Covering the year 1979*. New York: Macmillan Educational Corporation, 1979.
- Collins, A. Processes in acquiring knowledge. In R. C. Anderson, R. J. Spiro & W. E. Montague (Eds.), *Schooling and the acquisition of knowledge*. Hillsdale, N. J.: Lawrence Erlbaum Associates, 1977.
- Flavell, J. H. *Cognitive development*. Englewood Cliffs, N. J.: Prentice Hall, Inc., 1977.
- Flavell, J. H., & Wellman, H. M. Metamemory. In R. V. Kail & J. W. Hagen (Eds.), *Perspectives on the development of memory and cognition*. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1977.
- Hooper, H., & Dalton, D. *Starting points in reading: A teacher's guidebook*. Toronto: Ginn, 1973.
- King, E. M. (Ed.). *Canadian tests of basic skills: Manual for administrative supervisors and counselors*. Toronto: Thomas Nelson & Sons, Limited, 1968.
- Kobasigawa, A. Retrieval strategies in the development of memory. In R. V. Kail & J. W. Hagen (Eds.), *Perspectives on the development of memory and cognition*. Hillsdale, J.: Lawrence Erlbaum Associates, 1977.
- Kobasigawa, A., & Barnett, K. M. *Children's knowledge about retrieval strategies*. Paper presented at the biennial meeting of the Society for Research in Child Development, Boston, Massachusetts, April, 1981.
- Kobasigawa, A., Ransom, C., & Holland C. Children's knowledge about skimming. *Alberta Journal of Educational Research*, 1980, 16, 169-182.
- Mainland, D., & Murray, I. M. Tables for use in fourfold contingency tables. *Science*, 1952, 116, 591-594.
- Markman, E. M. Realizing that you don't understand: Elementary school children's awareness of inconsistencies. *Child Development*, 1979, 50, 643-655.
- Myers, M., & Paris, S. G. Children's metacognitive knowledge about reading. *Journal of Educational Psychology*, 1978, 70, 680-690.
- Shiffrin, R. M. Memory search. In D. A. Norman (Ed.), *Models of human memory*. New York: Academic Press, 1970.
- Thomas, E. L., & Robinson, H. L. *Improving reading in every class*. Boston: Allyn & Bacon, Inc., 1975.
- Thorn, E. A., Braun, C., & Richmond, M. I. *Comprehension strategies 3*. Toronto: Gage Educational Publishing, 1974.
- Wessells, M. G. *Cognitive psychology*. New York: Harper & Row, Publishers, 1982.
- Wiens, H. J. *China*. Grand Rapids: The Fideler Company, 1966.

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Orientation to School and Transitions of Children Between Primary Grades

The perceptions and opinions of Kindergarten, Grade 1, Grade 3, and Grade 4 teachers, principals, and a stratified random sample of parents about children's orientation to Kindergarten and their transition from Kindergarten to Grade 1 and Grade 3 to Grade 4 were examined using questionnaires. Results are reported on initial adjustment to school, orientation programs, difficulty of children making transitions, reasons for difficulty, use of and reasons for K-1 transition classes, use of shortened days in September, and need for increased teacher communication. Recommendations made to the school board are reported.

And the first step, as you know, is always what matters most, particularly when we are dealing with those who are young and tender. That is the time when they are easily moulded and when any impression we choose to make leaves a permanent mark.

Plato, *The Republic*, 337

In many cultures and times, the beginning has been considered a most critical point of an endeavor. For the young child, one of the most important experiences is the beginning of public school. Kindergarten is the initial exposure of most children to public education and thus plays a part in the establishment of life-long attitudes towards school and education.

Kindergarten may be either a beginning or a continuation. For many children, Kindergarten is the next educational step after nursery school or day care. For other children, it is truly a beginning in which the child must make the transition from home to school. A central topic of this study is this transition from day care/nursery school or home to Kindergarten. It is important to discover how, as well as how successfully, children's initial orientation to public education is facilitated.

Ideally, Kindergarten should be part of the educational continuum that spans primary, intermediate and the upper grades. For most children, the transition from Kindergarten to Grade 1 involves adjustment to a longer day and a more formalized curriculum in a more structured day than children experienced in

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Kindergarten. The question arises as to whether or not this transition causes difficulties for some children; if this seems to be a problem, what are some probable causes and what may be some possible solutions?

The next major transition in the school life of primary level children is the transition from Grade 3 at the end of the primary program into Grade 4 at the beginning of the intermediate program. Again, the question has been raised as to whether or not this transition causes difficulties for some children.

This study was initiated by the Commission on Education for the Board of School Trustees of Greater Victoria District to investigate Kindergarten children's orientation to school and their transition from Kindergarten to Grade 1 and the later transition from Grade 3 to Grade 4 as perceived by teachers, administrators and parents.

Method

In the study questionnaires to teachers, principals and parents were utilized as the primary strategy for obtaining information. Interviews of School District personnel were used to obtain other specific information.

Subjects

The Kindergarten questionnaire was sent to the entire population of Kindergarten teachers in School District #61. Similarly all Grade 1 teachers, Grade 3 teachers, Grade 4 teachers, and elementary principals received a questionnaire relevant to their particular level. Teachers of split grades (e.g., Grade 1/Grade 2) were not included unless the only class at that grade level in a school was a split grade. The teacher of such a class was included as it was judged important that every school be represented at each of the four grade levels used in the survey. Schools with highly specialized programs (e.g., hospital-based) or special organization (e.g., nongraded) were not included because of their atypical nature.

A stratified random sample was used for parents of children currently enrolled in Kindergarten, Grade 1, and Grade 4. The school district was divided into quadrants equalized by elementary school enrolment. Three schools were randomly selected from each quadrant. All parents of Kindergarten, Grade 1, and Grade 4 children in these schools received questionnaires specific to their child's grade level.

The total number of subjects in each group surveyed and the return rates for the questionnaires are summarized in Table 1.

Procedure

Separate questionnaires using five-point Likert scale, yes/no, and completion formats were developed for each of the following groups: Kindergarten teachers, Grade 1 teachers, Grade 3 teachers, Grade 4 teachers, principals, parents of Kindergarten children, parents of Grade 1 children, parents of Grade 4 children. Items for these questionnaires were drawn from a variety of sources including a previous district Kindergarten questionnaire, recent Gallup polls, *Language B.C.* (1976), current curriculum guides, interviews with district personnel, recent research and professional literature.

As a result of a pilot study, the questionnaires were revised and the final forms of the questionnaires were mailed. A cover letter invited respondents to telephone

the researcher if they had any questions or additional concerns; several people did so.

TABLE 1
RATES OF RETURN ON QUESTIONNAIRES

Group	Number Questionnaires Sent	Number Questionnaires Returned	Rate of Return
Kindergarten Teachers	44	39	89%
Grade 1 Teachers	51	47	92%
Grade 3 Teachers	52	49	94%
Grade 4 Teachers	54	51	94%
Principals	36	36	100%
Parents of Kindergarten Children	96	53	55%
Parents of Grade 1 Children	96	71	74%
Parents of Grade 4 Children	96	54	56%

Results and Discussion

The results are reported in the following order: (1) initial adjustment to Kindergarten, (2) transition from Kindergarten to Grade 1, and (3) transition from Grade 3 to Grade 4.

Initial Adjustment to Kindergarten

The first step in examining the initial adjustment of children to Kindergarten was to ascertain the views of Kindergarten teachers, principals, and parents of Kindergarten children as to the importance of this transition into school. These groups indicated a high percentage of agreement with the statement “The transition into Kindergarten is very important in setting the tone and determining how a child will feel about school” (adapted from Weinberger, 1976). (See Table 2.) Among Kindergarten teachers, 90% strongly agreed with the statement. There was general overall agreement among principals and parents of Kindergarten children. No parent disagreed with the statement while there was slight disagreement by principals and Kindergarten teachers.

In response to the question “Do you think some children have difficulty adapting to Kindergarten?”, 92% of the Kindergarten teachers and 94% of the principals marked “Yes” while 8% and 6%, respectively, marked “No.” Those who had responded affirmatively were asked to indicate the percentage of girls and the percentage of boys who typically have difficulty adjusting to Kindergarten. Both principals and Kindergarten teachers thought that a higher percentage of boys ($M_o=8-10\%$) had difficulty adapting to Kindergarten than did girls ($M_o<5\%$). Neither thought a majority of girls had difficulty while 17% of the Kindergarten teachers and 22% of the principals indicated a majority of boys had difficulty adapting to Kindergarten. This result seems consistent with the general pattern of boys having more difficulty throughout school than girls.

TABLE 2
 RESPONSES OF TEACHERS, PARENTS, AND PRINCIPALS TO STATEMENTS
 ON CHILDREN'S INITIAL ADJUSTMENT TO KINDERGARTEN

	Strongly agree	Agree	Neutral -- Don't know	Disagree	Strongly Disagree
The transition into Kindergarten is very important in setting the tone and determining how a child will feel about school.					
Kindergarten teachers (n=39)	90%	-	-	10%	-
Principals (n=36)	53%	44%	-	3%	-
Kindergarten parents (n=47)	64%	34%	2%	-	-
Each elementary school in each community could plan and implement an educational program for parents who have young children about to enter Kindergarten or already enrolled in Kindergarten.					
Kindergarten teachers (n=38)	39%	45%	5%	11%	-
Principals (n=35)	23%	60%	6%	11%	-
Kindergarten parents (n=46)	37%	45%	9%	9%	-
The Kindergarten day in September should be shortened and then gradually extended during the first few weeks.					
Kindergarten teachers (n=39)	61%	26%	5%	8%	-
Principals (n=34)	29%	44%	6%	21%	-
Kindergarten parents (n=46)	19%	33%	2%	39%	7%

The parents of Kindergarten children were asked, "Did your child have difficulty adjusting to Kindergarten?" Of the 47 parents responding to this question, 17% said their child had difficulties. The reasons for this difficulty as given by six of these eight parents were: length of the Kindergarten day and the child's short attention span, shyness, language problem, learning problems and move into a new neighbourhood. These parents did not mention a late (i.e., October-December) birthday as being a factor although this is a frequently mentioned reason in the popular press.

Several parents who thought their child did not have difficulty adjusting to Kindergarten wrote comments indicating that this was due primarily to their child's previous attendance in a preschool program. As a result of these comments, a subsequent analysis was done. Of the 47 parents of Kindergarten children, 83% had enrolled at least one of their children in a preschool program. This result reflects the predicted national trend of more children attending a preschool

program due, at least in part, to the increasing number of working mothers with preschool aged children (National Day Care Information Centre, 1979). The previous preschool attendance of children has implications for both orientation to Kindergarten and the current curriculum.

The *Resource Book for Kindergartens* (1973) gave "some practical suggestions for the orientation of both children and parents to kindergarten" (p. 78). These suggestions were: (a) meeting parents during spring registration, (b) calling informal group meetings with parents in the spring to explain the program and answer questions, (c) arranging visits by parents and children to Kindergarten classroom, (d) doing home visits and using other methods of becoming acquainted with family backgrounds, (e) arranging for printed information to be sent to parents, sending a welcome letter to each child, and (f) asking one or two parents to assist in "the initial mechanics of the school opening" (p. 78). It should be noted that not all of these suggestions may be advantageous or even practical for all teachers in all situations.

Ninety-two percent of the Kindergarten teachers who returned the questionnaire ($N=39$) indicated that they and/or the school did some type of orientation work with children and/or parents in preparation for beginning Kindergarten. The most frequently reported type of orientation was an invited visit of children to the Kindergarten during the spring prior to their registration. The next most frequently reported type of orientation was interviews/visit in early September for the purpose of familiarization with the Kindergarten program, classroom, and teacher.

The least frequently reported type of orientation were home visits, distribution of parent handbook, and visits by Kindergarten teacher to neighbourhood day care centres and return visits by children to Kindergarten classroom. Only one teacher reported no contact with parents or children in preparation for beginning Kindergarten. This infrequent use of home visits and visits to day care centres may be due to a lack of the release time necessary for this type of activity.

A recommendation resulting from a comprehensive review of the research related to children's entrance age into first grade (Hedges, 1977) was that "each elementary school in each community could plan and implement an educational program for parents who have young children about to enter Kindergarten or already enrolled in Kindergarten" (p. 151). (See Table 1.) The high percentage of agreement among Kindergarten teachers, principals and Kindergarten parents indicated a common viewpoint. In practice, it appears that any program to explain Kindergarten is at the discretion of and implementation by the Kindergarten teacher. Thus the Kindergarten teacher seems to have the responsibility for establishing early parent-school contacts.

Parents of Kindergarten children were also asked if they thought the school could have helped them in any way in preparing their child for school. This question originated from a Gallup poll (1979) which found most parents with children already in school responded negatively while most parents whose children were not yet in school responded affirmatively. In this study, as in the Gallup poll, the majority (62%) of the parents of Kindergarten children responded negatively. A follow-up question asked those (38%) who had responded affirmatively to suggest ways this could have been done. The most frequent suggestions were:

1. Provide more information about the program
2. Arrange more time for parents to talk to the teacher

3. Permit child to visit Kindergarten more than once before September
4. Arrange for child to visit once
5. Arrange for parent to visit.

These suggestions are also similar to the results of the Gallup poll. The recurring theme seems to be the need by parents for more access to information sources.

In discussing the schedule for beginning Kindergarten, the *Resource Book for Kindergartens* (1973) suggests that "shortened sessions initially are advantageous . . . [and] that not until sometime during the second week should a full two and one-half hour session be considered" (p. 79). The responses of Kindergarten teachers, principals, and parents of Kindergarten children to the statement: "The Kindergarten day in September should be shortened and then gradually extended during the first few weeks" were almost equally divided between agreement and disagreement for the Kindergarten parents, while both the Kindergarten teachers and principals expressed more agreement (see Table 2). A possible explanation for some parents' dislike of shortened days was indicated in additional comments made by some parents stating that their children had been enrolled in a preschool or day care program and therefore were accustomed to longer days. This system of shortened sessions can pose problems for working mothers who must arrange for additional care during this time. As a system of shortened days has been valued and accepted by various educational writers and groups (Morgan, Hofstra, Black & Skinner, 1979), there may exist a need to explain more fully to parents why the system is used and what the benefits are for the children.

To determine to what extent and which patterns of shortened sessions were actually being implemented, Kindergarten teachers were asked if their Kindergarten sessions in September were shortened. Fifty-nine percent responded affirmatively and 66% of these teachers used shortened days for a period of three weeks or more. Approximately one-fifth (21%) used a shortened day schedule for one to two weeks.

In summary, Kindergarten teachers, principals, and parents agreed that the transition into Kindergarten was very important in setting the tone and determining how a child will feel about school. Boys were judged to be more likely to have difficulty adjusting to Kindergarten than girls. Nearly all Kindergarten teachers did some type of orientation work with parents and/or children, most frequently a visit of the children to the Kindergarten during the Spring prior to their registration. There was strong support among Kindergarten teachers, principals and parents of Kindergarten children for a program to explain the Kindergarten program to parents.

Transition from Kindergarten to Grade 1

A second purpose of this study was to determine if children had difficulty making the transition from Kindergarten to Grade 1. Kindergarten teachers, Grade 1 teachers, and principals were asked "Do you think some children have difficulty making the transition to Grade 1?" The parents of Grade 1 children were asked "Did your child have difficulty making the transition from Kindergarten to Grade 1?" The Kindergarten teachers, Grade 1 teachers, and principals were then asked to give the approximate percentage of boys and girls who had difficulty making the transition from Kindergarten to Grade 1.

Ninety percent of the Kindergarten teachers, 92% of the Grade 1 teachers and 86% of the principals indicated that they perceived that some children had

difficulty making the transition from Kindergarten to Grade 1. Of the Grade 1 parents who responded, 28% said their child had difficulty making this transition. This is a higher percentage (28% vs. 17%) of parents than those who indicated their child had trouble adjusting initially to Kindergarten.

The percentage of boys and girls who reportedly had difficulty making the transition from Kindergarten to Grade 1 ranged from zero to over 95%. The most frequently given percentages for girls having difficulty were in the range of 5-10% for teachers and principals. The same is true for boys. These ranges are similar to those given for Kindergarten boys but higher than those for Kindergarten girls. However, a very different pattern emerged for the second most frequent range of percentages. For girls, the second most frequently reported range was under 5%; for boys it was over 50% (no one indicated that more than 50% of the girls had difficulty). The pattern of responses among the Kindergarten teachers, and Grade 1 teachers and principals showed a high degree of agreement. This pattern is similar to that found by Conway (1968) who studied School Districts 39 (Vancouver) and 61 (Greater Victoria) and found that, in the opinion of primary teachers, the "well-adapted pupils" were usually girls and the "poorly-adapted pupils" were usually boys (p. 27). This pattern also holds for the transition between Grades 3 and 4 discussed later.

Once it had been determined that some children are perceived to have difficulty making the transition from Kindergarten to Grade 1, Kindergarten teachers, Grade 1 teachers, and principals were asked why they thought some children had difficulty making this transition. The parents of Grade 1 children who stated that their child had difficulty were asked what they thought was the reason for this difficulty. Among these groups, there is no consensus but rather three distinct "areas" of difficulty. Nearly half the Grade 1 teachers (48%) and Kindergarten teachers (43%) thought the reason for this difficulty was "Immaturity" often as a result of late (i.e., October-December) birthdays. None of the parents and only 4 1/2% of the principals suggested late birthdays/immaturity as the reason. The pattern of principals' responses was an equal split (32%) between "Health Reasons" and "General Readiness." The third area of difficulty was given by 50% of the parents ($N=22$) who reported that their child had difficulty making the K-1 transition because of the increase of expectations for children in Grade 1. The increased structure of Grade 1 and its curriculum was the reason given by 27% of the Kindergarten teachers and 17% of the Grade 1 teachers.

Perhaps one of the most important factors in dealing with any difficulties children may have because of the increase in expectations is the communication and understanding among all groups concerned as to what these expectations are. Kindergarten teachers, Grade 1 teachers, and principals were asked to respond to the statement: "There should be more coordination of Kindergarten and primary grade programs to promote understanding by all teachers of the expectations upon time as well as a more effective transition for children from one level to another" (recommended in *Language B.C.*, 1976, Vol. 1, p. 29). (see Table 3.)

There was a relatively high percentage of agreement between Kindergarten teachers and Grade 1 teachers on the need for more coordination. There was a lesser degree of agreement among principals as well as the highest percentage of disagreement as to the need for more coordination for the purpose of promoting more understanding of the expectations. A similar, though less strong, pattern of response was seen in the answers to a more general statement that "There is a need

for increased communication between Kindergarten and Grade 1 teachers” (see Table 3).

TABLE 3
RESPONSES TO TEACHERS, PARENTS, AND PRINCIPALS TO STATEMENTS
ON CHILDREN TRANSITION FROM KINDERGARTEN TO GRADE 1

	Strongly agree	Agree	Neutral -- Don't know	Disagree	Strongly Disagree
There should be more coordination of kindergarten and primary grade programs to promote understanding by all teachers of the expectations upon them as well as a more effective transition for children from one level to another.					
Kindergarten teachers (n=39)	49%	36%	7.5%	7.5%	-
Grade 1 teachers (n=47)	40%	38%	11%	7%	4%
Principals (n=36)	22%	44%	11%	20%	3%
There is a need for increased communication between Kindergarten and Grade 1 teachers.					
Kindergarten teachers (n=39)	38.5%	38.5%	5%	18%	-
Grade 1 teachers (n=46)	32.5%	32.5%	11%	20%	4%
Principals (n=36)	11%	45%	8%	33%	3%
There is a need to make provision for "mature" or "bright" children for whom less than a full year of Kindergarten is sufficient.					
Kindergarten teachers (n=39)	23%	33%	13%	28%	3%
Grade 1 teachers (n=44)	23%	30%	20%	23%	4%
Principals (n=35)	20%	57%	11%	9%	3%
Kindergarten parents (n=47)	28%	32%	15%	21%	4%
Grade 1 parents (n=68)	28%	40%	10%	16%	6%

The group which was most concerned with the difficulties of children in the K-1 transition caused by the increase of expectations was the parents of Grade 1 children. Half of the parents whose children had difficulty with the K-1 transition gave this as the reason. Other parents whose children did not have any difficulty wrote comments that indicated a desire for information about what was expected of their child and what the child would be doing during the year. These parents stated that they did not feel they knew enough about the expectations for their

individual children nor how or if they could help their child to be more successful in meeting these expectations. Throughout this study, recurring supplementary comments by parents indicated that they wanted to know more about (a) what their child was doing, (b) how well their child was doing, and (c) what they could do to help their child.

A Kindergarten - Grade 1 transition class is seen traditionally as an opportunity for those children who have completed Kindergarten and are not ready for Grade 1 to experience a program that is more advanced than the Kindergarten program but not as advanced as Grade 1. When Kindergarten teachers, Grade 1 teachers, and principals were asked to state the advantages and the disadvantages of Kindergarten - Grade 1 transition classes, all three groups most frequently reported "giving children more time to mature" as the foremost advantage followed by "giving children more time to master specific skills." The third most frequent advantage given by principals and Grade 1 teachers was that "a transition class permits more individualized teaching." The third advantage given by the Kindergarten teachers was "the prevention of the development of a pattern of failure." The most frequent response of all three groups as to the disadvantages of a Kindergarten - Grade 1 transition class was that there was no disadvantage. The administrative and organizational difficulties of such a possibly small class (e.g., bussing) was the second most frequently given disadvantage.

For children who were judged not to be ready for Grade 1, the options were either placement in a K-1 transition class (if one is available) or retention. In order to determine the degree of use of these options, Kindergarten teachers (who had been teaching Kindergarten in this District the previous year) were asked what percentage of children were retained in Kindergarten or placed in a K-1 transition class. Of the 11 Kindergarten teachers who stated that children were retained, four retained 1% of the class, four retained 5%, and three retained 10%. Of the five teachers who stated that children were placed in a K-1 transition class, two teachers reported 10%, three other teachers reported 20%, 80%, and 100% respectively placed in a transition class. The fact that only five teachers placed children in transition classes was probably more a reflection of the unavailability of such classes rather than a limited need for transition classes. Several teachers wrote that placement in a transition class was not an available option at their school.

The other side of the issue of retention is the issue of acceleration and enrichment for children who are "bright" enough and "mature" enough to need more than is provided in the regular Kindergarten program. If such children are to be challenged to the limit of their abilities, special provisions within the classroom or in a special class may need to be made.

Kindergarten teachers, Grade 1 teachers, principals, parents of Kindergarten and Grade 1 children were asked to respond to the following statement which is based on one of the recommendations in *Language B.C.* (1976): "There is a need to make provision for 'mature' or 'bright' children for whom less than a full year of Kindergarten is sufficient" (p. 63). Slightly more than half of the Grade 1 and Kindergarten teachers agreed with this statement (see Table 3). The parents of Kindergarten and Grade 1 children expressed a high percentage of agreement. Both the highest percentage of agreement and lowest percentage of disagreement were expressed by the principals.

In summary, a high percentage of Kindergarten and Grade 1 teachers and principals indicated that some children (usually boys) have difficulty making the

transition from Kindergarten to Grade 1. Of the Grade 1 parents, one-quarter thought their child had difficulty. The most frequently given reasons for difficulty were (a) immaturity, (b) health reasons and general readiness factors, and (c) increase of expectations for children in Grade 1. Teachers and principals favoured K-1 transition classes for children who need more time to mature as well as for children for whom less than a year of Kindergarten would be sufficient. Teachers and principals agreed that there was a need for more coordination of Kindergarten and primary grade programs and more communication between Kindergarten and Grade 1 teachers.

Transition from Grade 3 to Grade 4

Another purpose of this study was to try to determine if teachers, parents, and principals perceived the transition from Grade 3 to Grade 4 to be difficult for children. The parents of Grade 4 children were asked "Did your child have difficulty making the transition from Grade 3 to Grade 4?" Grade 3 teachers, Grade 4 teachers, and principals were asked "If you think some children have difficulty adjusting to Grade 4, approximately what percentage are girls? boys?"

Of the parents of Grade 4 children who responded, 22% reported that their child had difficulty making the transition to Grade 4; 78% reported their child did not have difficulty. These percentages are very similar to those of Grade 1 parents (28% vs. 72%) on their children having difficulty making the transition from Kindergarten to Grade 1.

Approximately one-third of Grade 3 (33%) and Grade 4 teachers (31%) and 78% of the principals indicated that they thought some children had difficulty adjusting to Grade 4. In interpreting the data on the percentages of boys and girls, there was a very wide range from zero to over 50%. The most frequently given percentages for girls having difficulty were in the range 5-10% for teachers, while principals indicated under 5%. Teachers and principals most frequently indicated the 5-10% range for boys. However, a more varied pattern emerged in the second most frequent range of percentages. For girls, the second most frequently reported range was under 5% for Grades 3 and 4 teachers, and 5-10% for principals; for boys it was over 50% for Grade 3 teachers, 41-50% for Grade 4 teachers, and under 5% for principals. With the exception of the principals' responses, these results are again similar to those on children having difficulty between Kindergarten and Grade 1.

Of the parents whose children had difficulty making the transition from Grade 3 to Grade 4 ($N=12$), 50% said this was because their child was poorly prepared academically. The second most frequent reason given (17%) was the child's non-Canadian background. As to what the school could have done to help, 46% stated that the school had helped/was helping. Twenty-seven percent indicated that the school could have provided extra help for their child earlier (i.e., in the primary grades).

In response to three questions on children's difficulty in making the Grade 3 - Grade 4 transition being due to (a) curriculum/instructional materials, (b) teacher style/attitude or (c) social adjustment, the pattern of response by Grade 3 and Grade 4 teachers and principals was one of general disagreement to either teacher style/attitude or the difference of curriculum and instructional materials as a primary cause of difficulty. Seventy percent of the Grade 3 teachers and 51% of the principals disagreed with social adjustment as the primary cause. Half of the

Grade 4 teachers (50%) agreed. Thus, there seemed to be no strong consensus as to a primary cause for children's difficulty making the Grade 3 - Grade 4 transition.

One possible approach to the Grade 3-4 transition period is one of a variety of activities/programs to familiarize children with Grade 4 teachers, curriculum, materials, expectations, etc. Grade 3 teachers, Grade 4 teachers, and principals were asked to "Describe any orientation work carried out by you and/or the school with children in preparation for beginning Grade 4." "No orientation work" was the response of 36% of Grade 3 teachers, 85% of Grade 4 teachers and 32% of principals when asked to describe what preparation was done for Grade 4. Of those who indicated that some work was done, 33% of Grade 3 teachers said they began "more Grade 4 type work" (e.g., more independent activities, research projects, longer written assignments). Orientation work reported by Grade 4 teachers was negligible.

Grade 3 and 4 teachers, principals, and parents of Grade 4 children were asked "Do you favour a specific orientation program to help Grade 3 children make the transition to the intermediate grades? Why or why not?" A majority of Grade 3 teachers (65%), Grade 4 teachers (82.5%), principals (80%), and parents of Grade 4 students (70%) did not favour such a program. The most frequently (42%-53%) given reason by all groups was that it was unnecessary.

In summary, the majority of parents, principals, Grade 3 and 4 teachers indicated that the transition between Grade 3 and 4 was not a problem for most children. For children having difficulty (mostly boys), poor academic preparation was the reason given most frequently. The majority of Grade 3 and 4 teachers, principals, and parents did not favour a specific orientation to help children make the Grade 3-4 transition because they felt such a program was unnecessary and that individual teachers should and could deal with the difficulties of individual children. However, parents at all levels (Kindergarten, Grades 1 and 4) indicated they would like more information on what was expected of their child during the year and what the child would be doing.

Summary of Findings

A majority of Kindergarten teachers, principals, and parents of Kindergarten children agreed that the transition into Kindergarten was very important in setting the tone and determining how a child will feel about school. Not one parent disagreed with this statement although a tenth of the teachers and two-fifths of the principals disagreed.

Over three-quarters of the Kindergarten and Grade 1 teachers and principals surveyed indicated that they thought some children had problems making the transition into Kindergarten or between Kindergarten and Grade 1. The pattern of response changed somewhat for the transition between Grades 3 and 4: approximately a third of the Grade 3 and 4 teachers thought some children had problems while again three-quarters of the principals thought there were problems.

When asked if *their* child had difficulties making a transition, 17% of the Kindergarten parents, 28% of the Grade 1 parents, and 22% of the Grade 4 parents said yes. When asked for their perceptions of the reason for the problem, Kindergarten parents most frequently gave "child-centred" reasons (i.e., child's short attention span, shyness, language problem, learning problem, newness in neighbourhood); parents of children in Grades 1 and 4 gave "school-centred"

reasons (i.e., increased expectations for children in Grade 1 and poor academic preparation prior to Grade 4).

Principals and teachers at all three levels indicated that they thought boys had more difficulty making these transitions between grades than did girls. The most frequently given percentage for all groups ranged from 0 to 10% for both boys and girls. However, the second most frequent percentages given by Grades 1, 3, and 4 teachers were less than 5% for girls but 41% or more for boys. Principals responded similarly except for the Grade 3-4 transition where they indicated less than 5% for the boys.

Nearly all Kindergarten teachers did some type of orientation work with children and for parents (most frequently a visit of the children to the Kindergarten during the spring prior to their registration). There was strong support among Kindergarten teachers, parents, and principals for an educational program for parents of children about to be or recently enrolled in Kindergarten. The majority of Kindergarten and Grade 1 teachers and principals agreed that there should be more coordination of Kindergarten and primary programs and more communication between Kindergarten and Grade 1 teachers in order to facilitate children's transitions. On the other hand, 36% of the Grade 3 teachers, 85% of the Grade 4 teachers and 32% of the principals stated that no orientation work was done for children during the Grades 3-4 transition. The most frequent type of activity was beginning more Grade 4 type work. When asked if they favoured a specific orientation program, a majority of Grades 3 and 4 teachers, principals, and Grade 4 parents indicated no, most frequently for the reason that such a program was unnecessary.

Teachers and principals favoured K-1 transition classes for children who need "more time to mature" as well as for children for whom less than a year of Kindergarten would be sufficient. These groups also favoured shortened Kindergarten sessions in September while Kindergarten parents were divided in opinion.

Conclusion

Recommendations were made to the Commission on Education based on the results of this study. One recommendation was that the Kindergarten teachers, Grade 1 teachers, and principals at each school assess the needs of the children and parents and determine if an orientation program to Kindergarten and/or Grade 1 would be appropriate and advantageous. Such a program could meet the needs expressed by parents, teachers and principals for an opportunity to explain these programs and answer questions as well as provide an opportunity for children to experience school activities and meet the teachers. It was recommended that the School Board support any school wishing to implement such a program by providing such funding and release time as may be needed.

Another recommendation was that more Kindergarten - Grade 1 transition classes be established to meet the needs of both the child who is not ready for Grade 1 at the end of Kindergarten and the mature or bright child who needs to progress to a higher level than can be easily provided within the current Kindergarten program. It was further recommended that K-1 transition classes be taught by teachers with training and experience at both the Kindergarten and Grade 1 levels (staffing was not seen as a problem because of the availability of such teachers).

It was recommended also that the policy of shortened Kindergarten days at the beginning of September for the purpose of easing the initial adjustment to school be re-evaluated in terms of the needs of the individual children. An increasing number of children are being enrolled in preschool programs and children who have been in full day programs are less likely to need shortened days than those with no preschool experience. Provision should be made to meet the needs of each of these children in their beginning of Kindergarten.

No recommendations were made about the Grade 3-4 transition, as the groups surveyed did not indicate that this was a problem area.

References

- Conway, C. B. *A study of public and private kindergarten and non-kindergarten children in the primary grades.* Victoria: B.C.: Department of Education, 1968.
- Gallup, G. H. The 11th annual Gallup Poll of the public's attitudes toward the public schools. *Phi Delta Kappan*, September 1979, 61, 33-45.
- Hedges, W. D. *At what age should children enter first grade: A comprehensive review of the research.* Ann Arbor, MI: University Microfilms International, 1977.
- Language, B.C.* Victoria, B.C.: Department of Education, 1976.
- Morgan, G. A. V., Hofstra, G., Black, E., & Skinner, L. *Children's characteristics on school entry.* Toronto: Ontario Ministry of Education, 1979.
- National Day Care Information Centre. *Status of day care in Canada.* Ottawa: Health and Welfare Canada, 1979.
- Resource Book for Kindergartens.* Victoria, B.C.: Department of Education, 1973.
- Weinberger, P. Early education guide: Evaluating and planning ahead. *Teacher*, 1976, 93(9), 73-74.

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Changing Plans and Aspirations of High School Students

Longitudinal studies of student aspirations are complex and consequently rare. This study investigated changes in high school student plans and aspirations during a twelve-year period, 1969 to 1981. Even though the changes overall were not very obvious, substantial changes were observed when the responses of boys and girls were analyzed separately. One of the more significant findings was that while there was a slight increase in the number of students who planned for postsecondary education, the schools placed considerably fewer students in the university entrance program in 1981 than they did in 1969.

The plans and aspirations of high school students have been examined sporadically by researchers and educators for many years and for various purposes. Following the proliferation of studies in the late 1960's, the number of studies on student concerns appeared to decline as research focused more on such immediate problems as declining enrolments and the effectiveness of schools. The activism of the previous decade had subsided and new problems not closely tied to the quiet student generation of the 1970's were the subject of investigation. Thus by 1980 the press to be heard by students had diminished considerably and was generally not the major factor in educational planning for the future.

By 1980, however, interest revived in the whole area of the quality and usefulness of student educational experiences, especially in high schools. This is well illustrated by such studies as *The Quality of School Life* by Trevor Williams and Margaret Batten (1981) in which the authors examined student experiences in Australian high schools. Some of the most visible and influential studies, influential especially in their policy implications, were attempts to obtain comprehensive data on the way in which students view their schooling. Two of these studies were *High School and Beyond* (1981) directed by James Coleman and *A Study of Schooling* (1981) under the direction of John Goodlad.

Both of these studies raised questions about changes in student culture and the implications of these changes for school programs, but thus far neither has

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addressed directly the problem of students' plans and aspirations and the relationship of these plans to program placement. They have, however, questioned the appropriateness of current high school programs and current practices of student placement into programs.

Peng, Fetters and Kolstad (1981), reporting on part of the Coleman study, illustrate the marked differences between public high schools and private high schools in program placement of students.

About one-third of the 1980 seniors in public high schools (34 percent) took an academic program to prepare for college, and 27 percent took a vocational program to prepare for an occupation after high school. In private high schools, this distribution was markedly different. Over two-thirds (70 percent) took an academic program, and 9 percent took a vocational program. These distributions reflect a basic difference in orientation of the two types of schools. Yet the experience and concerns of students in the same type of program are often more similar to one another, even though they are in different types of schools, than they are to those in a different program in the same type of school. (p. 1)

Benham, Giesen, and Oaks (1980), part of John Goodlad's research team, conclude that "Students who don't expect to go to college tend to believe that their high school doesn't consider them very important." They add:

Our findings suggest that, as a rule, students with lower self-concept scores do not plan to go on to any form of higher education. From the literature, we know also that future plans often determine (or are determined by) track placement. Are these students usually found in the lower-ability tracks? If so, it is likely that in some secondary schools these students, and those with higher self-concepts and future plans that include some form of education beyond high school, may rarely encounter each other. It may be that this variable greatly influences peer relationships at the school level. (p. 340)

Goodlad et al. (1979), reflecting on their "A Study of Schooling," conclude that:

This study will have achieved one of its several purposes if it stimulates more and better explorations of what goes on in schools. . . . It will have achieved another if it enlightens our understanding of schools. . . . And it will have achieved a third purpose if groups seeking to improve local schools are stimulated to study and analyze what goes on there. (p. 178)

In a small measure these objectives apply as well to the study reported in this paper. The question of changes in students' plans and aspirations over the past decade remains largely unanswered, as does the question of the appropriateness of current programs for students in the light of their plans for the future. A recent study has provided some interesting information on changes that have occurred in these matters in a Canadian setting.

The Study

The responses of a stratified random sample of 1981 grade 9-12 students to a questionnaire entitled "Student Values Inventory" were compared to those of grade 9-12 students in the same school system surveyed in 1969. The number of students in the 1981 sample was 2 285 compared to the population of 12 951 students reported in the 1969 survey. The proportion of male and female students was approximately the same in both studies (50 percent male), as was the proportion in each of grades 9 to 12.

The school system in which the surveys were carried out is urban in nature with a population of over half a million. It has experienced rapid growth during the period under examination, and it continues to provide every indication for further growth. The changes that have occurred since 1969 are far reaching, involving

expansive growth in most sectors: government, industry, education, and housing. In spite of city policy for distributing lower income housing to most sections of the city, there has been a fairly clear trend for the higher income families to locate in certain sections. As a consequence, since high schools are primarily neighborhood schools, this trend has also maintained the socioeconomic differences between schools in the city. Unemployment has usually been considerably below the national average in Canada, making it possible for students to find work, even during the school year.

One section of the questionnaire dealt with students' plans and aspirations as well as with the current program in which they were enrolled. This paper presents an *analysis of the plans and aspirations of the students* in the two surveys with a view of detailing some of the *significant shifts that may have occurred over the twelve-year period*, and to see how these are reflected in student program placement.

The analysis focuses first on three items which reveal the aspiration level of the students. This is followed by an examination of the plans that the students have for their postsecondary years. Third, an examination of the current programs in which the students are enrolled is carried out to observe the congruence or lack of congruence between the plans and aspirations and the current placement of students in school programs. The paper ends with a few of the significant observations related to the findings on students' aspirations, plans and program placement.

Aspirations of High School Students

The data in Table 1 indicate that students in 1981 were somewhat more desirous of being remembered as outstanding students than were the 1969 students. The difference between the sexes observed in 1969 was sustained; both male and female students showed an increase of 2 percent in this category. In 1981 about 50 percent of the girls and 41 percent of the boys wished to be remembered as outstanding students rather than as athletic stars or as being most popular.

TABLE 1
PERCENTAGE OF 1981 STUDENTS WHO WISH
TO BE REMEMBERED AS OUTSTANDING STUDENTS

Students	1969 (N=12951)	1981 (N=2285)	Change
Boys	39.2%	41.3%	+2.1%
Girls	47.5	49.5	+2.0
ALL STUDENTS	43.3	45.4	+2.1

The students were also asked to indicate what level of university education they anticipated to achieve. The analysis of the responses to this item is provided in Table 2. The analysis is restricted to the percentage of students who expected to earn a university degree.

TABLE 2
PERCENTAGE OF 1981 HIGH SCHOOL STUDENTS
WHO EXPECT TO EARN A UNIVERSITY DEGREE

Students	1969 (N=12951)	1981 (N=2285)	Change
Boys	44.4	42.0	-2.4
Girls	31.2	40.4	+9.2
ALL STUDENTS	37.8	41.2	+3.4

Overall the proportion of students who expected to earn at least one university degree increased from 37.8 to 41.2 percent. However, the significant changes occurred between the sexes: the proportion of boys who expected a university degree declined by 2.4 points while that for girls increased by over 9 percentage points. This is tantamount to a 30 percent increase for the girls and a 5 percent decline for boys who expect to earn a university degree.

The findings in the study *High School and Beyond* (1981) indicated that 46 percent of the U.S. seniors expected to complete a degree program. In comparison, 48.6 percent of the Edmonton grade 12 students have similar expectations.

Table 3 provides a comparison of expected median income of students ten years after high school.

TABLE 3
EXPECTED MEDIAN INCOME OF HIGH SCHOOL STUDENTS
TEN YEARS AFTER SCHOOL

Students	1969 (N=12951)	1981 (N=2285)
Boys	\$8,478	\$36,638
Girls	6,554	31,785
ALL STUDENTS	\$7,540	\$34,142

The income students expected to make ten years after high school increased more than fourfold during the twelve-year period. Several interesting observations arise out of these findings. First, the difference in expectations between boys and girls was maintained, even though the expectation of the girls increased slightly more than that of the boys. Second, the expectations of the students remained very close to their estimated family income. To illustrate, in 1969 the estimated median family income was \$6,327 which was just slightly lower than the expected income by students of \$7,540 in that year. In 1981 the estimated median family income was \$31,954, again somewhat below the expected student income of \$34,142.

In summary, the 1981 students wished to be remembered more as outstanding students than did the 1969 students. A considerably greater proportion of the 1981 girls and a smaller proportion of 1981 boys expected to earn a university degree compared to the 1969 students. All of them expected an income that was at least four times the 1969 expected income and slightly above the estimated current family income.

Plans of High School Students

The plans of high school students were obtained through student responses to three items which are analyzed below.

The first item relating to future plans requested students to indicate whether or not they had chosen their profession. The analysis of responses to this item is presented in Table 4.

TABLE 4
PERCENTAGE OF HIGH SCHOOL STUDENTS
WHO HAVE CHOSEN THEIR PROFESSION

Students	1969 (N=12951)	1981 (N=2285)	Change
Boys	53.3%	56.7%	+3.4%
Girls	59.6	55.6	-4.0
ALL STUDENTS	56.4	56.2	-0.2

Overall no change occurred in the percentage of students who had chosen their profession. However, the data show that 3.4 percent more boys and 4 percent fewer girls had chosen their profession in 1981 compared to their counterparts in 1969. That change removed the discrepancy based on sex which existed in 1969. About 56 percent of the students indicated that they had chosen their profession.

TABLE 5
PERCENTAGE OF HIGH SCHOOL STUDENTS WHO EXPECT
TO ENROL IN A TECHNICAL INSTITUTE

Students	1969 (N=12951)	1981 (N=2285)	Change
Boys	29.5%	38.8%	+9.3%
Girls	17.0	29.1	+12.1
ALL STUDENTS	23.2	34.1	+10.9

Students were also asked to indicate if they planned to enter a technical institute after high school. The data, as presented in Table 5, reveal that a substantial increase has occurred from 1969 to 1981 in the proportion of students who plan to enrol in a technical institute. The increase for girls is somewhat greater than that for boys with the combined proportion increasing from 23.2 to 34.1 percent.

Finally, students were asked to state whether or not they planned to go to junior college, teachers' college, nurses' training, or university after high school. Just over 50 percent of the students indicated that they planned to attend university (as described in the item), practically unchanged from the plans indicated in 1969. Table 6 presents the summary of the responses.

TABLE 6
PERCENTAGE OF STUDENTS WHO PLAN TO ATTEND
UNIVERSITY OR RELATED INSTITUTIONS

Students	1969 (N=12951)	1981 (N=2285)	Change
Boys	50.2%	45.8%	-4.4%
Girls	49.6	56.3	+6.7
ALL STUDENTS	49.9	51.0	+1.1

The most significant finding in relation to university plans was that the proportion of boys planning for university education declined by 4 percentage points while that for girls increased by close to 7 percentage points.

In summary, students' plans have changed substantially from 1969 to 1981. A greater proportion of boys and a smaller proportion of girls have chosen their profession. The difference between them in this regard had disappeared. A considerably larger proportion of students plan to pursue technical education. Lastly, a smaller proportion of boys and a larger proportion of girls plan to pursue university type education.

Current Status of High School Students

Two items were analyzed to see whether the changes in aspirations and plans were congruent with the students' current school placement and experiences. The first sought information about favorite subjects, and the second information about program placements of the students.

As is evident from the data in Table 7, a shift has occurred in the degree to which mathematics and science are seen as favorite subjects. The change is especially significant for the girls. In total, 28 percent of the students chose these subjects as their favorite ones, an increase from 23 percent in 1969.

The percentage of students in the academic program (university entrance) is provided in Table 8. For this table only, the sample was restricted to students in grades 10-12, because the grade 9 students are not always placed in a particular program.

TABLE 7
PERCENTAGE OF STUDENTS WHO CLAIM THAT MATHEMATICS
AND SCIENCE ARE THEIR FAVORITE SUBJECTS

Students	1969 (N=12951)	1981 (N=2285)	Change
Boys	28.9%	31.7%	+2.8%
Girls	17.1	24.2	+7.1
ALL STUDENTS	23.0	28.0	+5.0

TABLE 8
PERCENTAGE OF STUDENTS IN THE ACADEMIC PROGRAM
(Grades 10-12)

Students	1969 (N=9730)	1981 (N=1704)	Change
Boys	60.7%	41.8%	-18.9%
Girls	56.9	47.4	- 9.5
ALL STUDENTS	58.8	44.5	-14.3

The percentage of students in the academic program has declined sharply during this 12-year period, dropping to 44.5 percent from 58.6 percent in 1969. The decline, though substantial for both sexes, is especially sharp for boys. The proportion dropped 18.9 percentage points from 60.7 to 41.8 percent. It is worth noting that in 1969 a greater proportion of boys than of girls were in the academic program; in 1981 it was reversed.

To sum up this section it is interesting to note that a greater proportion of the 1981 students saw mathematics and science as their favorite subjects compared to the 1969 students. However, more significant was the finding that a much smaller proportion of high school students were enrolled in the academic program in 1981 than in 1969. The decline was especially precipitous for boys.

Related Findings, 1981 Students Only

A number of related findings, especially in regard to student curricular placement, were obtained through further analysis of the data. Placement in the academic program was not significantly related to students' having a job or to mothers' having a job outside the home.

On the other hand, placement in the academic program was significantly and positively related to the father's occupational status, student attitude toward achievement, frequency of Sunday School or church attendance, and time spent on homework. It was negatively related to time spent watching television.

Just about 80 percent of the students in the academic program planned to enter university. Just over 35 percent of those in the general program also planned to enter university, for which they were apparently not being prepared.

The extreme variation between schools in student placement in the academic program poses a serious problem for system-wide policy making. The percentage of Edmonton students in the academic program ranged from 81 percent in one school to 21 percent in another. The range in percentage of students in the general program in schools varied from 19 percent to 55 percent. Coleman points out that 70 percent of students in U.S. private schools were in the academic programs, in sharp contrast to the U.S. public schools in which 34 percent of the students were placed in the academic programs.

Finally, as can be seen from Table 9, the desire for change in programs was fairly strong among the 1981 Edmonton high school students. Perhaps, most germane to this analysis was the finding that 19 percent of the students in the general program and 25 percent of those in the vocational program would like to change their programs.

TABLE 9
PROGRAM CHOICES 1981 HIGH SCHOOL STUDENTS
WOULD MAKE IF COMPLETELY FREE TO DO SO

Program in which students were placed	Choices Students Made (in percentages)			
	Remain in Program	Change Program	Change School	Leave for Work
University Entrance (N=738)	77%	11%	9%	3%
General (N=520)	64	19	8	9
Vocational (N=396)	55	25	6	14

Findings and Observations

The Technological Trend

Overall the 1981 high school students revealed a slight trend toward a more academic orientation. This trend was centred around a much greater appreciation of mathematics and science, and a greater disposition toward further preparation in technical areas, as well as continued interest in university education. About 55 percent planned to enter university and 35 percent planned for technical education. There is overlap in these figures but they indicate a high level of academic/technical aspiration.

The Economic Drift

Expectations of much higher income in the future suggest a real change among students. However, the change appears to be closely tied to current experiences of family income and thus the trend can be described as a drift consonant with the rapid escalation of income during the 12-year period. The students failed to project inflation in their income aspirations, as did the students in the 1969 survey.

The Male Female Shift

All indications pointed to a higher female enrolment and a decreased male enrolment at the university in years ahead. Female students also indicated much more interest in technical education than did their counterparts in 1969. The overriding value change in which money has become a major factor in the student culture may be partly responsible for the shift that has occurred. Boys in greater numbers appear to have found avenues toward achieving paying positions through jobs rather than through education; girls may have found the reverse to be the case for them. A fairly large proportion of boys exhibit a new awareness that they can develop their self-concept and independence much faster through work than through further education.

The Program Paradox

The rapidly decreasing proportion of students in the university entrance programs in schools seems completely contrary to the plans and aspirations of the students themselves. More than one-third of the students in the general program entertained plans for a university education. The great variation in student placement practices between schools suggests that inequities in student treatment may have crept into the system. This view is reinforced by the large percentage of students presently in the general and vocational programs who would like to change their programs. This paradox points to a need for further research, and if such research supports the findings of this study, it calls for a major policy revision in curriculum and in student placement in programs.

Conclusions and Implications

It is possible that in the desire to provide more options and programs in high schools, inequities in treatment of students have been increased. Decentralized programming, school-based examinations, and student choices of courses may have led to greater disparity in actual treatment of students even though designed to create situations where schools would be able to meet student needs on a more individual basis. The great differences between schools in the proportion of students in the academic stream does not reflect students' aspirations nor in all likelihood their ability. The need for a large scale study of curriculum for Alberta youth is strongly suggested by the findings of this study. What in the present pattern of behavior of students and in their plans and aspirations of the future is important for curriculum? How can the students be best prepared as they choose to work or to enter postsecondary education? At this moment the schools do not appear to reflect the increasing academic nature of students nor their increased aspiration level, especially by the girls. Perhaps the usefulness of the general program in the educational experiences of students is in need of careful review.

A further study is suggested relating to student placement in programs. Does the province grant students a right to an academic education if they desire it? If this is the case, is it being denied to some students directly through school placement of students into programs? Do schools encourage students to reduce their expectations rather than raise them by placing them in a challenging program? Do schools deny students access into programs they might benefit from most? Do they take into account students' plans or expectations?

An additional question is raised by student placement policies and practices. There is sufficient evidence that where students are expected by schools to perform

well they tend to do so. The reverse is also true. This self-fulfilling prophecy principle may be operating at times to students' disadvantage in school placement decisions. Does this violate the democratic right of students to receive the best possible education in our public schools?

Inseparable from this concern is the role of guidance and counselling in schools. To what degree do these services act in accord with other school practices to respond to the needs of students? Are they responsive to the educational and other plans of students, expressed or unexpressed? Has the traditional guidance function become somewhat inappropriate for modern youth? Is it possible that many students are placed in groups where they will be denied working with highly motivated students? Benham et al. (1980) recognize the importance to learning of the nature of the group of students with whom an individual is associated. They state that "Highly structured curriculum tracks in high school may produce distinct student cultures, greatly limiting the range of peer relationships" (p. 340).

Clearly the postsecondary educational institutions may have to look carefully at their programs and clientele. The indications that the proportion of girls will continue to increase in universities and colleges while that of boys will decrease presents an interesting challenge. The continuing increase in demand for technical education is also a factor to be noted. The results of the study seem to indicate that Alberta youth is viewing the future with great reality. Their significantly higher value placed on money or wealth together with a somewhat increased value on postsecondary preparation appear to be clearly reflected in their outlook and plans for the future.

Perhaps the most significant feature of the student plans is the substantial increase in the number of students who expect to complete graduate degree programs. The proportion of students with such plans has doubled and girls now have practically the same expectations for postgraduate study as the boys.

The questions raised thus far are disturbing, especially to those who believe that the school, as developed in North America, has a special role in moving society toward equality and in nurturing educational development within each student. Perhaps after thorough rethinking of our educational offerings we might find that schools have failed to achieve their basic educational goals. Jackson (1982) points out that the schools are probably "inefficient institutions for equalizing income or reducing class differences, and can make only limited contribution to eliminating prejudice and stereotyping" (p. 98). In fact, unless a thorough analysis of the philosophy and practice occurs to alert educators to the consequences of their actions, schools can actually become counterproductive in achieving equality and quality in education, even though both objectives are almost universally supported.

The overall conclusion that is suggested by the findings of this study is that the plans and aspirations of many students in our high schools may be thwarted by the practices of schools in placing them in positions which make their plans unrealistic. There are hardly any outside controls or checks on the schools which, consequently, vary widely in their curriculum and placement policies. If these findings are supported by more in-depth studies, a rethinking of our secondary school philosophy and practice is of utmost urgency. Could it be that schools are not responsive to students who anticipate a future unlike the one that is suggested by the current high school curriculum? Do some of the current high school programs have the effect of limiting the opportunity of those students who take them?

Of particular importance to the theory of curriculum development is the place of the student in such a model. How can curriculum theorists incorporate a meaningful student component, a practical component in a model for curriculum development? How can this model be communicated to the curriculum decision makers in school? Who can monitor the individual schools and ensure that curriculum offerings and placement of students in programs reflect quality and equality in education, and ensure that the students' plans and aspirations for the future are a meaningful component in the educational process?

Two other research problems are suggested by the findings of this study. One relates to an examination of the relationship between economic conditions in a society and students' aspirations and program placement in schools. The other centres on the nature of the relationship of students' aspirations and placement in programs to decentralized curricula and decentralized budgeting. Both areas could prove rewarding in providing information on the important area of students' plans and the school system responses to these plans. The findings might throw light on why changes occur over time in student placement into programs and why differences in placement practices appear between schools and between school systems.

The nationwide survey in the United States by Yankelovich Associates (Bennis, 1976, p. 166) reveals that there is a diminishing of differences among young individuals with regard to basic lifestyles, goals and career aspirations. The survey shows that the difference between classes has practically evaporated. Bennis (1976) concludes that on the basis of this, "we're going to have to create institutions in which people can feel the responsibility of growing and continuing to learn, where contributions are prized, and where independence and autonomy are encouraged" (p. 167).

Willower (1982, p. 92) suggests that public schools still tend to see their students "as reflection of the larger society" which they picture as a class society. Consequently, "lower class or working class students are more likely to suffer academically, have fewer opportunities for leadership, and be treated less well than their counterparts from more advantaged social class backgrounds." Willower's conclusion seems to receive considerable support from the findings of this study especially in the way students have been increasingly placed in a "general course." This may not permit the students to prepare themselves for the future, the shape of which is always speculative.

Further research is suggested to examine in greater detail the aspiration-program paradox that seems to emerge. Bennis (1976, p. 161) talks of the "entrepreneurial vision, a sense of perspective, and, most of all, the time to spend thinking about the forces that will affect the destiny" of an institution. It takes leadership, courage and knowledge to prescribe to each student a program that is the most challenging investment for his or her future, a program that is not based on past stereotypes or classes but on the aspirations, potentials and future environment of the learner.

References

- A Study of Schooling. Series of Technical Reports. Los Angeles: UCLA, 1980-81.
Benham, B. J., Giesen, P., & Oaks, J. A study of schooling: Students' experiences in schools. *Phi Delta Kappan*, 1980, 61(5), 337-340.

- Bennis, W. *The unconscious conspiracy*. New York: AMACOM, 1976.
- Coleman, J. S. *High school and beyond*. Washington, D.C.: National Center for Educational Statistics, 1981.
- Friesen, D. *The urban teenager*. Edmonton: University of Alberta, 1969.
- Friesen, D. Value orientations of modern youth. *Adolescence*, 1972, 7(26), 265-276.
- Goodlad, J. I., Sirotnik, K. A., & Overman, B. C. An overview of a study of schooling. *Phi Delta Kappan*, 1979, 61, 194-198.
- Jackson, M. Three decades. *Ninth Yearbook*, Canadian Society for the Study of Education, 1982, 93-99.
- Oaks, J. Limiting opportunity: Student race and curricular differences in secondary vocational education. *A study of schooling*, Technical report No. 28. Los Angeles: UCLA, 1981.
- Peng, S. S., Fetters, W. B., & Kolstad, A. J. *High school and beyond: A capsule description of high school students*. Washington, D.C.: National Center for Educational Statistics, 1981.
- Ravitch, D. The meaning of the New Coleman Report. *Phi Delta Kappan*, 1981, 62(10), 718-720.
- Williams, T., & Batten, M. *The quality of school life*. Victoria, Australia: The Australian Council for Educational Research Limited, 1981.
- Willower, D. J. School organizations: Perspectives in juxtaposition. *Educational Administration Quarterly*, 1982, 18(3), 89-110.

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An Examination of the Effects of Extending the Practicum on the Professional Dispositions of Student Teachers

This paper contains a comparison of the effect of length of practica on three professional predispositions of student teachers. Two Canadian teacher education programs were chosen, one having a three-week practicum, the other lasting twenty weeks. Student teachers completing the longer program had significantly lower values than similar student teachers completing the shorter program. Discussion centers on the problems of spending a prolonged period of time in this indeterminate role situation and its possible influence on the student teacher's perception of reality. It is proposed that only after a lengthy practicum does the impact of the nature of the job overcome the idealized view of the profession.

The decade of the eighties should prove to be a time of thoughtful consideration for education faculties. Following the initial shock of the dramatic decline in public school enrolments and its subsequent effect on teacher education institutions, educators have realized that they now have an unprecedented opportunity to improve their programs to promote the further professionalization of teachers. For the first time in several decades, faculties of education are not required to rush teachers through inadequate programs in an effort to meet a crisis situation. In attempting to improve the professionalization process, education faculties are reassessing their academic requirements as well as the socialization

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process that enables students to become teachers. The area of greatest concern in this socialization process is the student teaching practicum. Because practising teachers and student teachers universally view the practicum as a peak learning experience, faculties of education have been under great pressure to extend the length of the practicum and incorporate many of the features found in other professional internships. As faculties of education continue to examine these options, the lack of adequate information becomes more apparent.

The purpose of this report is to examine only one aspect of this professionalization process, the practice teaching component. Furthermore, this study will consider only three professional attitudes of student teachers as they are influenced by extension of the practicum. It should be noted that in this research, the influence of extending the practicum on the technical competencies of teachers is not studied; rather the attitudes that may predispose a teacher to become a more professional teacher are examined. While it is recognized that improved technical competencies are essential to the further professionalization of teachers, in this study it is claimed that there is a second professional dimension of equal importance: the notion of professional commitment which separates expert technicians from professionals. Weber (1947) refers to it as "the devotion to a task for its own sake without ulterior motives" (p. 33). While this concept of service is more difficult to evaluate than the attainment of technical competencies, it is argued that the development of certain professional predispositions is essential if the recruit is to be considered to be something more than a teaching technician.

The conventional wisdom in Canada maintains that the extension of student teaching practica will promote the professionalization of teachers. Evidence that this belief is widespread was presented by Richards and Thiessen (1978):

There has been a national trend towards longer periods of student teaching resulting in the so-called internship which may be up to sixteen weeks in length. The rationale for such a trend has been well documented and is accepted by almost all institutions. (p. 63)

The current study expresses reservations about this trend on two very basic points. First that this expansion of the student teaching practica has often taken place without a concomitant increase in the total teacher education program. That is, in most universities across Canada it is still possible to graduate with only one year of teacher education. Allen (1976) singled this out as his initial concern about student teaching practica: "Unless total time is increased, extra time in schools will reduce time on campus and consequently reduce the amount of course work that many professors and teachers consider essential" (p. 47). The second concern, the one that is examined more closely in this study, is the influence of the extended practica on the professional predispositions of student teachers. Once again Allen (1976) has voiced this concern and appealed for more empirical research on the topic:

There is some evidence that a practicum can damage a student teacher's professional self-concept (Coulter, 1974; Wright & Tuska, 1966). Recommendations by researchers who have identified this tendency include gradual introduction to teaching at varying rates, emphasis on productive communication between student and supervisor and careful counselling. (pp. 47, 48)

Rationale

The present study is an extension of research (Clifton & Covert, 1977) which was concerned with the effects of the length and nature of the practice teaching

experience on certain professional attitudes of student teachers. In the current paper the student teaching practica at two Canadian universities are examined in terms of three professional dispositions: motivation towards teaching, attitudes towards teaching as a career, and self-concept as a student teacher. The reason for selecting these two programs for analysis is that they represent the extremes in time spent doing practice teaching in Canada. Most of the students in the Western university participate in a total of twenty weeks of practice teaching, while most of the students in the Eastern university have three weeks of practice teaching. More precisely, of the 39 weeks devoted to teacher education at the Western university, roughly one-half of the time is spent in practice teaching, while at the Eastern university, about seventeen percent of the one-year teacher education program is composed of a teaching practicum.

While these are the most obvious differences between these two teacher education programs, there are several others which serve to confound any similar comparative studies. The educational priorities of the two teacher education programs are obviously quite different and the faculties are composed differently with varying competencies. The student body is mainly an indigenous one, which means that they may be shaped by two separate and distinctive cultures. Given these typical problems, every effort has been made to ensure that the two samples are matched on those characteristics that compose background information for comparative purposes in research of this type.

The Practica

The Eastern university has four different practice teaching programs; however, the vast majority of student teachers (over 80%) enroll in a practice teaching program which concludes with a two-week block of practice teaching in the spring. These student teachers observe in a number of different classrooms for one-half day each week during a 13-week semester. Following the end of the academic year, they spend two weeks in one school completing their practice teaching. During the two-week period, each student teacher works closely with a cooperating teacher who is responsible for assisting the student teacher and evaluating his or her performance. Therefore, students participating in this student teaching program would have approximately three weeks of actual classroom experience prior to their certification. The research reported in this paper was concerned only with the two-week block of student teaching.

The teacher education program at the Western university is basically a one-year program, with both elementary and secondary students completing their studies within three 13-week terms. Out of a total of 39 weeks, approximately 20 are spent in a practice teaching situation. In order to accommodate this large student teaching component, classroom teachers-on-leave (Faculty Associates) are employed for a one-year period with the possibility of a one-year renewal. These Faculty Associates work closely with their student teachers in the schools and are responsible for instruction in certain methods and techniques of teaching, liaison between schools and university, and general supervision of the student teachers during the practicum.

The practice teaching periods are separated into two blocks of time spent in the schools. The first is a six-week experience which follows one week of introduction to classroom teaching. During this first term, student teachers are introduced gradually into their teaching responsibilities by tutoring individuals, working with

small groups, and eventually presenting a lesson to the whole class. Before the end of the six weeks, each student will prepare and present a unit from his or her chosen curriculum area. Following this period of practice teaching, the students return to campus for the second half of their first term for a course in which they reflect on their classroom experiences and study a variety of teaching concepts and skills.

The second practice teaching period follows and is for an entire 13-week semester. This course is designed to induct the student teacher into the teaching role by gradually building the teaching load from one-third of a load to a full load in the final four weeks of the semester. This experience is also supervised by the Faculty Associates in conjunction with the cooperating teachers in the schools. The students spend a third semester on campus, taking courses that will complete all of the academic, professional, and certification requirements. The research conducted for this study is the result of measurements taken only during the 13-week semester of practice teaching. These two university programs are represented diagrammatically in Figure 1.

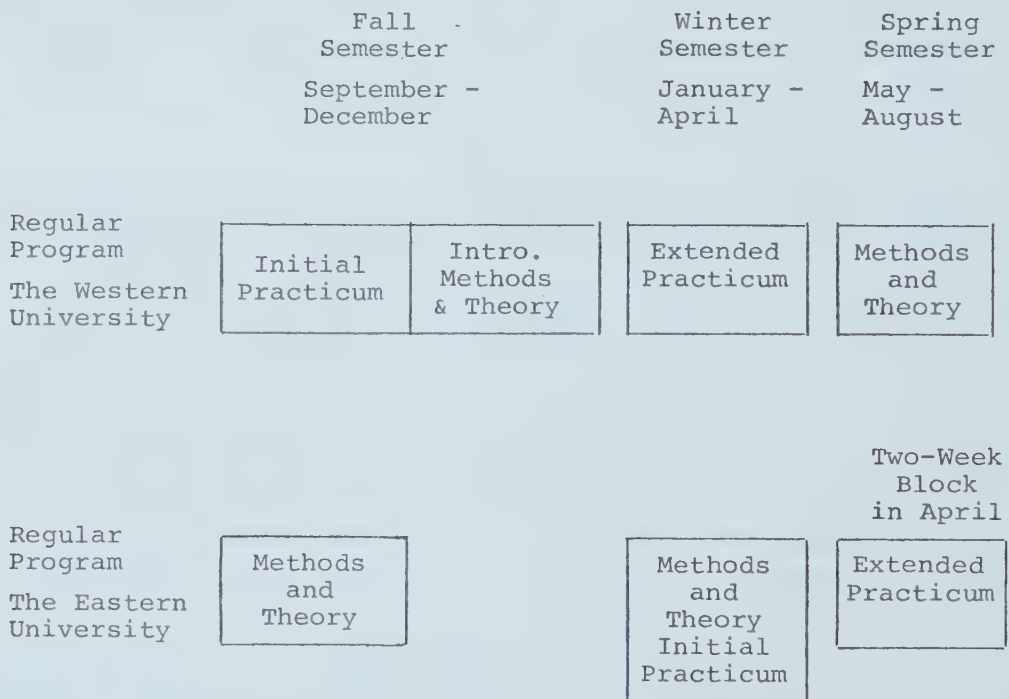


Figure 1.

Method

Sample

Practice teaching is a required component of the teacher education program at both universities. In the Eastern university all students who were enrolled in the student teaching course were asked to complete a questionnaire during the first week of September 1977. From this group of student teachers, 103 completed a second questionnaire at the end of the two-week block in April 1978. From this latter group, 30 student teachers who had completed both the first and second questionnaires were randomly selected for this study.

Similar questionnaires were administered to the Western university student teachers in January of 1980. In this instance, 133 student teachers completed the first questionnaire prior to beginning their 13-week semester of student teaching. From the group who had completed the first questionnaire, 81 completed a second questionnaire at the end of their student teaching experience. From this latter group a random sample of 30 was selected to provide the comparative data.

Methodology

Data were analyzed for two groups of student teachers at two Canadian universities undergoing different kinds of practice teaching programs. In all instances the questionnaire asked the students to identify themselves and give such background information as age, sex, and year of university, in addition to completing sets of items designed to measure self-concept, motivation, and attitudes. Each questionnaire took approximately 20 minutes to complete. Following the data collection, the mean scores on three dispositions were compared across the groups of students in order to determine whether there were significant differences. In addition, changes in the scores between the beginning and the end of the testing period were examined.

The Dependent Variables

In this study, three dependent variables were used: self-concept as a student-teacher, motivation towards teaching, and attitudes towards teaching as a career. In order to construct these dependent variables a number of questionnaire items, drawn from a variety of sources, were factor analyzed. Principal component solutions were used and items were considered to load on a factor if their factor loading was .35 or greater (Nunnally, 1967, p. 315). Since unidimensional scales were constructed by adding the appropriate items together, only one factor was extracted from each set of items.

The measure of self-concept as a student teacher was constructed from seven items on a semantic differential (see Osgood, Suci & Tannenbaum, 1957; Osgood, 1962; Walberg, 1967). The semantic differential had nine original items but the factor analyses of these items suggested that a more parsimonious and meaningful scale could be constructed from the seven items which loaded on the first factor. These items were: Kind-Cruel, Pleasant-Unpleasant, Weak-Strong, Nice-Awful, Active-Passive, Happy-Sad, and Fair-Unfair. The loadings on the principal component were .59 or greater and the alpha reliability coefficient for the variable was .85.

The measure of motivation to become a teacher was constructed by summing seven Likert-like items obtained from a previous study (Clifton & Covert, 1977). All students were asked to indicate: their desire to become teachers, their motivation to do well in education courses this year, how hard they work at courses this year, the amount of work they are willing to do in order to become a teacher, the importance of becoming a teacher, their evaluation of teaching as an occupation, and their current level of competence to teach. None of these items had loadings below .39 on the principal component and the alpha reliability coefficient for the variables was .83.

Finally seven items were used to obtain a measure of the student teachers' attitudes towards teaching as a career. These items were obtained from an eleven-item scale constructed by Merwin & DiVesta (1959) and DiVesta and Merwin

(1960). The items sought to identify teachers' attitudes toward: the desirability of teaching as a career, the advantages and disadvantages of the job of teaching, the importance of teaching as a career, the sacrifice of long hours, extended college education and relatively low pay, the degree of commitment to the profession, the comparison of teaching with other jobs, and the level of enjoyment expected from teaching. For the seven items, the loadings on the principal component were at least .47 and the alpha reliability coefficient for the scale was .79.

Results

In the present study it was hypothesized that there were significant differences between the two groups for their mean scores on the three dependent variables. More specifically, it was hypothesized that, following the longer practice teaching programs at the Western university, the student teachers in this program would have significantly higher mean scores than at the beginning of the program and that the increase in mean scores for the student teachers in the two-week block at the Eastern university would not increase as dramatically.

Table 1 presents the means scores and *t* values for differences between the pretests and the posttests. In this table the term "pretest" implies the scores obtained from the first questionnaire and the term "posttest" implies the scores obtained from the second questionnaire. It should also be mentioned that student teachers at the Western and the Eastern universities had no significant differences on the background characteristics of age, sex, marital status, degree, year of university, and program of study.

TABLE 1
MEAN SCORES ON DEPENDENT VARIABLES
BY STUDENT TEACHING PROGRAM

Variable	Test	Eastern Students	Western Students
1. Self-concept as a student teacher	Pretest	28.73	30.38
	Posttest	30.37	30.89
	t-value	- 2.94*	- 1.14
2. Motivation towards teaching	Pretest	29.31	30.86
	Posttest	29.72	26.76
	t-value	- 0.72	13.49**
3. Attitudes towards teaching as a career	Pretest	37.14	38.87
	Posttest	37.93	28.14
	t-value	- 1.03	27.35**

* $p < .01$
** $p < .001$.

The results indicate that, when considering the pretest means only, the students at the Western university scored significantly higher on all three measures than similar students at the Eastern university. In view of the results of the pretest and posttest comparisons, it can be seen that while in both groups, student teachers' self-concept declined while on the practicum, only that of the Eastern students dropped significantly. Table 1 also indicates that the Western students

experienced dramatic drops in their motivation towards teaching and attitudes towards teaching as a career. Even though the Western students began their student teaching experience with higher attitudes in all three categories than those of the Eastern students, something that occurred during the practicum affected them adversely and influenced a highly significant drop in both their motivation and attitude.

Discussion

In this study it was hypothesized that the Western university student teachers participating in the 13-week practicum would have predispositions toward being professionals that would increase to a greater degree than those of the student teachers at the Eastern university who had participated in only two weeks of practice teaching. This hypothesis was derived from the conventional wisdom which pervades much of teacher education today and is supported by some of the recent research conducted in Canada dealing primarily with the professional attitudes of student teachers.

Gregory and Allen (1978), analyzing data very similar to those gathered in the current research, had results that supported this common sense hypothesis. As a result of their study, they claimed that the positive professional attitudes were attributable to the nature of the practicum experience. Such things as gradual introduction into the teaching activities, orientation sessions and workshops during the practicum, extended periods of time allowed in the classroom, teaming of student teachers and supervisors by practising teachers, all promote a favourable atmosphere for the development of positive attitudes.

In another study (Clifton & Covert, 1977) it had also been argued that the integration of the practicum with academic work was responsible for improved attitudes and self-concepts of student teachers. These socialization factors that encouraged the integration of the theoretical and practical program were present in the Western university student teaching program. In addition to these factors, the Western university student teachers had already completed six weeks of an introductory practice teaching experience prior to beginning the extended practicum. Furthermore, this introductory session was concluded just eight weeks prior to a 13-week practicum. It would seem that many of the initial problems would be overcome and the reintroduction into the school setting would proceed quite smoothly. Even though these conditions seem to have been met by the Western university teacher education program, these perplexing findings about professional attitudes persist.

One possible explanation of these findings might be developed from an ethnographic perspective. This approach would suggest that the four questionnaires given in this current study were in reality four snapshots of student teaching experiences taken at four different times. This hypothesis proposes that one picture was taken at zero weeks of student teaching (Eastern university pretest), a second at three weeks (Eastern university posttest), a third at six weeks (Western university pretest), and a fourth at twenty weeks (Western university posttest). This could be an explanation for the higher pretest scores of the Western university students; they had already completed a six-week practicum while the Eastern university students had had no previous student teaching experience.

Conclusions drawn from these observations would indicate that there was a trend toward improved motivation to become a teacher and a trend toward more positive attitudes about teaching as a career, at least up to the sixth week. There is, however, a significant decrease in both of these variables when the measures taken at the twentieth week are considered. In considering the self-concept variable, the same argument could be made. While there was a trend toward lower self-concept during the entire 20-week period, the only significant difference occurred within the first three weeks of the practicum. Therefore, the findings resulting from the ethnographic hypothesis would be no different than those coming from a comparison of pre- and posttest data within institutions. From an examination of the means of the four ethnographic snapshots one might conclude that improvements in professional predispositions reach a point of diminishing returns somewhere between the third and the sixth week, and following the sixth week dramatic declines in motivation to become a teacher and attitudes towards teaching as a career are quite possible. The data available for analysis in the current study do not lend themselves to making these kinds of comparisons and therefore the within institution comparisons are more appropriate.

Another study in which an attempt has been made to use this approach involves some unreported research which also used measures analyzed by Gregory and Allen (1978). In this thesis study, professional attitudes were measured at several points during the practicum and it was found that attitudes rose and fell depending upon the phase of the program. It was claimed, for example, that the ninth week was a particularly depressing time because student teachers were taking on a full teaching load with all of the attendant difficulties and tensions. It was further argued that by the thirteenth week these problems had been overcome and positive professional attitudes were developing.

In offering an alternative explanation about the socialization process of student teaching, it might be important to point out that the improvement in professional attitudes found in the earlier study by Clifton and Covert (1977) occurred when student teachers were enrolled in the first year of a three-year program; the students in this former study were not part of a one-year teacher education program. Perhaps their professional predispositions could be more idealized because they were not scheduled to do their practice teaching for at least two more years. This notion of an idealized view of the profession may play a larger role in describing student teacher attitudes than had previously been anticipated. If the student teacher has an unrealistic view of what teaching is like, it may be quite a shock to be exposed to the real situation.

Heddenorf (1969), in reporting similar findings, calls this phenomenon "Reality Shock." His analysis of data

suggests a sense of awareness on the part of the student that the real classroom and school situations are inconsistent with the expectations of the student . . . there is a move away from altruistic attitudes. The student teacher is no longer clearly supportive of the real or nominal value of the teacher as one who is altruistic. (p. 145)

This shock may not become fully realized until some time has elapsed "on the job." If the student teacher sees himself more like a student than a teacher, it would not be necessary to take on the responsibility of the job. This may help to account for his favourable attitudes towards teaching, especially since he knows that "practice teaching" will end in a few weeks. However, as the student teacher becomes more involved in the teacher role and the situation becomes more of a

responsibility, the possibility of escape becomes less of an option and therefore attitudes about the profession may decline.

The student teachers completing only two weeks of practice teaching had never experienced the effects of having 25 children in their charge for five hours a day, five days a week. Only with the shouldering of this constant responsibility will more realistic attitudes toward the profession surface. When this happens in the kind of marginal student teaching role situation described by Clifton (1979), the professional attitudes may be depressed. The longer the uncertainty persists about whether the student teacher is a student or a teacher, the more difficult it is to feel adequate in either role. While it may have been interesting to assume the role of teacher initially, the extended practicum may engender feelings of hostility and frustration because the learning has peaked and the task now becomes a drudgery devoid of adequate monetary or psychic rewards.

While many studies have indicated that longer practice teaching experiences help teacher trainees to become more proficient in performing the skills and techniques necessary for classroom performance (Beecher, 1950; Houston, 1967; Lupone, 1960; and Shea, 1964), none have found that the length of practicum has had a positive influence on teacher beliefs or values. It has been claimed in this study that the development of professional predispositions is as important to the professional teacher as technical competencies. This notion of professional commitment, which separates a professional teacher from a technically proficient teacher, is directly reflected in the attitudes and beliefs that recruits hold about teaching as a career. It seems appropriate that this sense of commitment should be developed as a part of the training of student teachers. It has been assumed that by extending the student teaching practicum, attitudes toward professionalism and teaching as a career would show gains similar to those experienced in technical competency. The results of this and other research raises doubts about the accuracy of this claim.

Much of that early research referred to above about the length of practica and its effect on professional attitudes is not very encouraging. For example, Walberg (1967b) found that student teachers' professional self-concepts declined as a result of their practice teaching experience. Furthermore, Kropp and Anderson (1963) state as a result of their study that "the internship semester does not seem to be an especially fruitful time during which to develop attitudes about the role of the teacher" (p. 369). More recently Cohen, Peters and Willis (1976) state that "the general consensus regarding the impact of the practicum experience is that it has little or no effect on the most ingrained educational beliefs of student teachers" (p. 15). Altman and Castek (1971), in their review of research, state the following: "Kinard (1968), Watson (1964) and Castek (1970), in separate studies, found no overall positive significant difference in student teachers' attitudes after one semester of practice teaching" (p. 46), and summarise their findings in this way:

From the studies reviewed, it appeared that not only could the practice teaching experience be described as being questionable in terms of developing a positive attitude toward teaching, but more seriously, as one with the potential for having a detrimental effect upon the teacher trainee. (p. 11)

It seems clear that more research needs to be done to see what influence the extended practicum has on student teachers. For example, a longitudinal study that followed student teachers, who had positive or negative professional predispositions during their practica, on to their first few years on the job might be undertaken to determine whether there is any correlation between professional

predispositions and the professional development of a teacher. Another study might investigate the development of professional attitudes among first year teachers who had experienced long or short practica. Perhaps the first year teachers could be questioned to determine if rewards received on the job have improved or depressed their professional attitudes and whether salary is adequate compensation for the encouragement of positive attitudes or if other psychic rewards are also necessary.

Perhaps Cohen, Peters and Willis (1976) summarize the research best when they state:

The matter of the effect of the length of the practicum on changing the preferences and beliefs has not yet been resolved. Since this is an important concern for teacher educators, it would seem necessary to compare practice of different lengths of time for their effects on preferences and beliefs of student teachers. (p. 20)

References

- Allen, I. D. Extending the practicum: Problems in integrating theory and practice. *Canadian Journal of Education*, 1976, 1(3), 43-51.
- Altman, B. E., Castek, J. E. *A comparative evaluation of the effectiveness of student teaching, interning and micro-team teaching in undergraduate teacher training*. 1971. (ERIC Document No. ED 059-184).
- Beecher, D. E. *The intensive teacher training program—An evaluation of results*. Albany: Division of Research, New York State Department of Education, 1950.
- Castek, J. E. *Changes in attitudes, philosophical views and knowledge of secondary education during student teaching*. Unpublished Doctoral Dissertation, University of Nebraska, 1970.
- Clifton, R. Practice teaching: Survival in a marginal situation. *Canadian Journal of Education*, 1979, 4(3), 60-74.
- Clifton, R. A., & Covert, J. R. The effects of an experimental program on the motivation and self-concept of student teachers. *Canadian Journal of Education*, 1977, 2(2), 23-32.
- Clifton, R., & Covert, J. Two experimental programs and the professional dispositions of student teachers, *The Morning Watch*, 1980, 7(3-4), 35-42.
- Cohen, A. S., Peters, D. L., & Willis, S. L. The effects of early childhood education student teaching on program preference, beliefs and behaviors. *Journal of Educational Research*, 1976, 70(1), 15-20.
- Coulter, F. The effects of practice teaching on professional self-image. *The Australian Journal of Education*, 1974, 18, 149-159.
- DeNevi, R. Toward planning a new model for teacher education. In L. Horton, & P. Horton (Eds.) *Teacher education: Trends, issues and innovations*. Danville, Illinois: Interstate Printers and Publishers, 1974.
- DiVesta, F. J., & Merwin, J. C. The effects of need-oriented communications on attitude change. *Journal of Abnormal and Social Psychology*, 1960, 60, 80-85.
- Gregory, A., & Allen, I. Some effects of the practicum on the professional self-concept of student teachers. *Canadian Journal of Education*, 1978, 3(2), 53-56.
- Heddendorf, R. H. *The student teacher and professional values*. Unpublished doctoral dissertation, University of Pittsburg, 1969.
- Houston, W. R. *A study of the teaching status of graduates of the elementary intern program at Michigan State University*. East Lansing: Michigan State University, 1967.
- Kinard, C. R. *A study of changes in openness of student teachers during the student teaching experience*. Dissertation Abstracts International, 1968, 28, 1466A.

- Kropp, R. P., & Anderson, J. E. Teacher roles before and after internship. *Journal of Educational Research*, 1963, 56(7), 366-369.
- Kulm, G. *The effects of practicum experience on the opinions of secondary mathematics teachers*. 1975 (Eric Document Reproduction Service No. Ed. 111 691.)
- Lupone, O. J. *A comparison of provisionally certified elementary school teachers and permanently certified elementary school teachers in selected school districts in the State of New York*. Unpublished Doctoral Dissertation, St. John's University, 1960.
- Merwin, J. C., & DiVesta, F. J. A study of need theory and career choice. *Journal of Counselling Psychology*, 1959, 6, 302-308.
- Nunnally, J. C. *Psychometric theory*. New York: McGraw-Hill, 1967.
- Osgood, C. E. Studies in the generality of affective meaning systems. *American Psychologist*, 1962, 17, 10-28.
- Osgood, C. E., Suci, G. J., & Tannenbaum, P. H. *The measurement of meaning*. Urbana: University of Illinois, 1957.
- Richards, L., & Thiessen, S. J. Some problems in the supervision of field experiences. *The education of teachers in Canada, Fifth Yearbook, Canadian Society for the Study of Education*, 1978, 63-69.
- Shea, J. S. *An assessment of an experimental elementary teacher education program*. Unpublished doctoral dissertation, University of Michigan, 1964.
- Tattersall, W. R. Patterns of change in teaching anxiety, professional self-concept and self-concept during an extended practicum: A study of student teachers in Simon Fraser University's Educ 405 Practicum, Spring 1979. Unpublished master's thesis, Simon Fraser University, 1979.
- Walberg, H. J. The development of teacher personality: Multivariate theory and analysis. *School Review*, 1967, 75, 187-196. (a)
- Walberg, H. J. *Effects of tutoring and practice teaching on self-concept and attitudes in education students*. 1967 (ERIC Document Reproduction Service No. ED 015 155). (b)
- Watson, C. K. *A study of the effects of student teaching upon the attitudes of prospective teachers and interns*. Unpublished doctoral dissertation, Northwestern University, 1964.
- Weber, M. *The theory of social and economic organizations*. A. M. Henderson, & Talcott Parsons, trans. New York: Oxford University Press, 1947.
- Wright, B. D., & Tuska, S. A. Student and first year teachers' attitude towards self and others. Cooperative Research Project No. 153, Office of Education, U.S. Department of Health, Education and Welfare, 1966.

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Sex-Related Differences in High School Science and Mathematics Enrolments: Do They Give Males a Critical Headstart Toward Science- and Math- Related Careers?

Although high school mathematics enrolments have been proposed as a critical step toward careers in science-related professions, this view appears flawed in not considering the quality of instruction and learning taking place in high school classrooms. We examined previously published evidence that has been adduced in support of the hypothesis that enrolments play a critical role and failed to find convincing support for the "enrolments effect" hypothesis. A re-examination of data on sex-related differences in the rate of decline in mathematics enrolments in grades 9 - 12 was carried out. The analysis suggested that these differences were too small in absolute magnitude to account for large gender differences in postsecondary career pursuits as was assumed. The article applies ideas from assimilation learning theory toward explaining these results with the hypothesis that large sex-related differences found in post-high school science and mathematics enrolments may result from a greater socialization of women into rote-mode learning strategies that are ineffective in advanced college mathematics and science courses and scientific careers.

High school mathematics enrolment has been proposed as playing a "critical filter" role in the career development of female scientists (Fennema, 1977; Gilmartin, 1976; Sells, 1976; Wise, 1978). The few women who do persevere in mathematics and the sciences tend to have a background in high school mathematics (Sells, 1976), and the thesis of this paper is that it is the quality of the

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instruction and learning taking place in the classroom, rather than mere attendance or enrolment in school mathematics, that provides the key to perseverance in science-related professions.

The theoretical perspective of this paper turns upon the distinction between rote and meaningful learning styles, a distinction which is rooted in a particular view of learning and memory. Precursors of this view, as early as Bartlett (1932), held that information only becomes meaningful and memorable through a constructive process whereby new inputs are linked with already existing schemata. This view stands opposed to the older associative learning theories that held that significant learning occurs automatically through repeated reinforcement. While those who offer mathematics enrolments as a critical variable in science careers do not do so with the intent of identifying themselves with associative learning theories, their thesis that mere exposure to high school mathematics is a critical variable ignores the possible role that alternative learning strategies may play in the cognitive and affective development of students enrolled in science or math courses. The perspectives discussed in this article, however, maintain that the extent of *meaningful* learning experiences, as contrasted with merely occupying seats in high school classrooms, are relevant to career perseverance. The assumption that meaningful learning occurs whenever students and teachers come together does not seem warranted.

The thesis of this article is that school socialization of women toward rote learning strategies provides an alternative explanation for the low persistence of women in science-related careers. The presentation of a theory regarding how this might occur will be deferred until evidence relevant to the "critical filter" hypothesis has been examined. This approach is called for since the latter hypothesis represents a widely held competing view of the role of mathematics and science enrolment in career development of women. Also, we are aware of no studies which directly test the thesis proposed here (though we contend thoughtful educators will not be surprised by our emphasis on teaching for understanding). Thus a brief review of prior relevant studies plus an analysis of previously published data relevant to the critical filter hypothesis, are offered as indirect evidence to support the major thesis of the article. Later we present some data from our research that support the thesis.

Relevant Studies: "Critical Filter" Hypothesis

Several investigators have used mathematics enrolments, or the decision to persist in mathematics, as criterion variables while searching for the variables which best predict these criteria (Fennema & Sherman, 1977; Pedro, Wolleatt, Fennema & Becker, 1981). Given the many difficulties inherent in predicting entry into professional careers, the selection of an intermediate criterion such as mathematics enrolment has a certain appeal even if the criterion itself has only a modest relationship with career entry. If that relationship is weak or negligible, however, the prediction of mathematics enrolment—while interesting and important in its own right—would be difficult to relate to the study of career perseverance. The fact that many women scientists had a background in high school mathematics (Sells, 1976) does not necessarily mean that mathematics enrolment is correlated with later career pursuits over the whole range of students.

The assumption that high school mathematics plays the critical role in science careers claimed for it by the investigators cited above appears to depend in their

view upon a demonstration of small sex-related differences in enrolments (cf. Fennema, 1977). Small differences in enrolments are not likely to be related to career selection unless there are qualitative differences in those enrolments. In general, evidence for the latter effect is limited.

Moreover, the evidence suggesting sex-related differences in enrolments is by no means clearcut. Fennema and her associates reported sex-related differences (Fennema, 1977; Fennema & Sherman, 1977; Konsin, 1976). On the other hand, Lantz and Smith (1980) reported no sex-related differences in intention to enroll or in actual enrolment in three separate samples. Differences that are reported are typically small and limited to the last year or so of high school (Fennema & Sherman, 1977).

In another recent study, Benbow and Stanley (1982) examined mathematics enrolments, achievement, and other variables for their participants in the Study of Mathematically Precocious Youth. They found that while there was differential mathematics course-taking in high school favoring the males, this could not explain the sex-related divergence in ability, appearing earlier and also favoring the males. For this reason, they found fault with the conclusion of Fennema and Sherman (1977) that sex differences in mathematical ability result from differential course-taking.

It could be argued that although males and females do not differ significantly in course enrolments, males achieve or retain more from such courses. However, studies such as that by Hyde (1981) show that gender differences on various assessments of cognitive performance were small and account for no more than 1% to 5% of the population variance, with some differences favoring males and some favoring females.

Re-examination of the Fennema-Sherman Study

Other grounds for questioning the Fennema and Sherman (1977) conclusions relative to the "critical filter" idea need to be examined. The small differences they reported occurred in their sample of four suburban Wisconsin high school districts. These authors noted that the rate of decline in mathematics enrolments through the high school grades, evident for both sexes, was faster for females than for males in these samples. They assumed that these differences are both significant and educationally important; i.e., related to well-documented sex-related differences in participation in science-related careers (Vetter, 1979). However, they did not report any statistical test to assure that the trend they noted is significant, and the overall sex differences were small (between 45 and 48 percent of those enrolled were female). Most of the difference between the sexes in enrolment was restricted to the senior year.

In view of the importance of sex differences in enrolments argued by these authors, two questions need to be answered: (1) Are these differences significant? (2) Are they large enough to support the assumption that enrolment differences provide a critical headstart for males? The first question merely addresses an omission in the previous research on this topic. The second goes on, however, to question whether differences are large enough in absolute magnitude to have the critical role these authors assume and if this assumption is well supported by the evidence they cite.

Method

In an attempt to answer these questions, an analysis of data reported by Fennema and Sherman (1977) was carried out.¹ The data on which Fennema et al. based their conclusions of significant sex differences are presented in their 1977 report (Fennema & Sherman, 1977, 56-57). This report gives summary statistics of enrolments in secondary mathematics in four suburban Wisconsin high school districts. These summary statistics were broken down by sex and grade level. In our analysis, a test of the degree of association between sex and grade in each of these four samples was done by means of point-biserial correlations.²

However, it is well known that significance levels of correlations, as of many other statistics, are affected by the size of the sample, such that with large sample sizes as those used by Fennema and Sherman, a correlation may be highly significant although small in absolute magnitude. In terms of the strength of relationship between the two variables, grade and sex, a more applicable method is to examine the squared correlation coefficient r^2 , representing the proportion of variance the two variables share in common. Therefore, squared correlations were also computed.

Results

Consistent with the report of Fennema and Sherman (1977), the correlations between sex and grade were significant. The rate of decline in enrolment from grades 9 through 12 was significantly faster for females than for males in all four schools. These results are summarized in Table 1.³ However, the correlations were small in absolute magnitude, ranging only as high as 0.14. The squared correlations ranged between approximately 0.002 and 0.02. These values are also shown in Table 1.

TABLE 1
POINT-BISERIAL CORRELATIONS BETWEEN SEX AND GRADE
IN TERMS OF MATHEMATICS ENROLMENTS IN FOUR SCHOOLS

School District	r p.b.	p	r^2 p.b.	Percent of Variance Not Accounted For
1	.14	<.005	.020	98
2	.10	<.0005	.010	99
3	.04	<.005	.002	99+
4	.09	<.0005	.009	99+

Note. Based on data published by Fennema and Sherman (1977).

Discussion

The results do not clearly support the implicit assumption of Fennema and Sherman (1977) that sex-related differences in enrolment decline have the import they attribute to them. Even though sex was significantly associated with enrolment decline, the sex-related difference in enrolment decline is extremely

small in absolute magnitude. In practical terms, the squared correlation coefficients reveal that there is practically no relationship whatsoever between sex and grade, i.e., most of the variance in college enrolments must be accounted for by other factors. (See Table 1.) Our computations correspond to the meta-analysis findings of Hyde (1981) in terms of the magnitude of sex differences, ranging from zero to two percent of total variance.

If males and females do not differ substantially in mathematics enrolments as a function of grade, it is a mistake to assume that this variable is necessarily critically related to postsecondary career pursuits. As a minimum, this analysis has cast doubt on the assumption that such a relationship exists. The data that Fennema and Sherman (1977) used to support the assumption now appear questionable in this regard. Thus, our re-examination agrees with Benbow and Stanley (1982) in challenging the purported critical role of high school mathematics course-taking.

The authors support efforts to understand and correct sex-related differences where they do occur, however slight they may be. We also agree with Fennema and Sherman (1977) that differences in participation must be controlled when comparing males and females on math-related abilities. However, the assumption that these differences are crucial to perseverance when they refer to traditionally male-dominated subjects, while understandable, is not necessarily borne out in this instance.

An Alternative Hypothesis

In the remainder of this paper, we would like to explore further a question that is left hanging at this point. If there is as yet no compelling evidence that secondary *enrolments* in mathematics play a critical role, how are the marked and extremely important sex-related differences in post-high school mathematics and science participation to be explained?

Our approach to this question is to apply certain ideas regarding meaningful versus rote learning and to relate these ideas to subsequent science-mathematics enrolments. Of course, the literature on career development is replete with other theories and relevant data regarding sex-related differences, but to review and assess these approaches is beyond the scope of this paper. Our recent review of the literature (Ridley & Novak, 1980) has suggested to us, however, that current approaches are almost totally lacking in an emphasis on the cumulative effects of *meaningful* learning experiences as one possible source of sex differences (discussed below). Therefore, we offer the following discussion of meaningful learning to complement current approaches and to suggest how the question posed above may be plausibly answered.

As stated earlier, the assumption that meaningful learning takes place automatically through instruction in high school mathematics classrooms and curricula appears to be implicit in the critical filter approach. We will argue, however, that meaningful learning occurs less often for females than for males. Females tend toward rote learning, which has been questioned increasingly as to its importance through a variety of theories emphasizing non-rote, or meaningful, learning (Anderson, Spiro & Montague, 1977; Ausubel, Novak & Hanesian, 1978; Bransford, 1979; Kintsch, 1974; and others). Although the critique of rote-learning approaches is a major piece of the puzzle, in our judgment it is the accumulation of meaningful learning experiences over time, within school environments, which is central here. The assimilation theory of David Ausubel is one which has dealt with

these matters quite systematically and thoroughly. We therefore turn to his theory for further insight; however, other theories emphasizing meaningful learning may yet be developed or elaborated to deal with these issues.

Ausubel (1968) and Ausubel et al. (1978) made the distinction between rote and meaningful learning wherein the latter involves non-arbitrary, relevant segments of the learner's existing cognitive structure. Meaningful learning requires (1) meaningful learning tasks (more or less present in all school learning), (2) relevant available concepts or propositions in the learner's cognitive structure (essentially always present in school-age learners), and (3) meaningful learning set (i.e., a deliberate set on the part of the learners to relate material substantively and non-arbitrarily to what they already know). The rote-meaningful distinction is not a dichotomy but rather a continuum. Since the extent of relevant cognitive structure available to assimilate a given segment of new knowledge varies from topic to topic and from learner to learner, and since the extent of meaningful learning set will also vary, individual learners may acquire a segment of new knowledge in a manner varying from near rote to highly meaningful (See Figure 1).

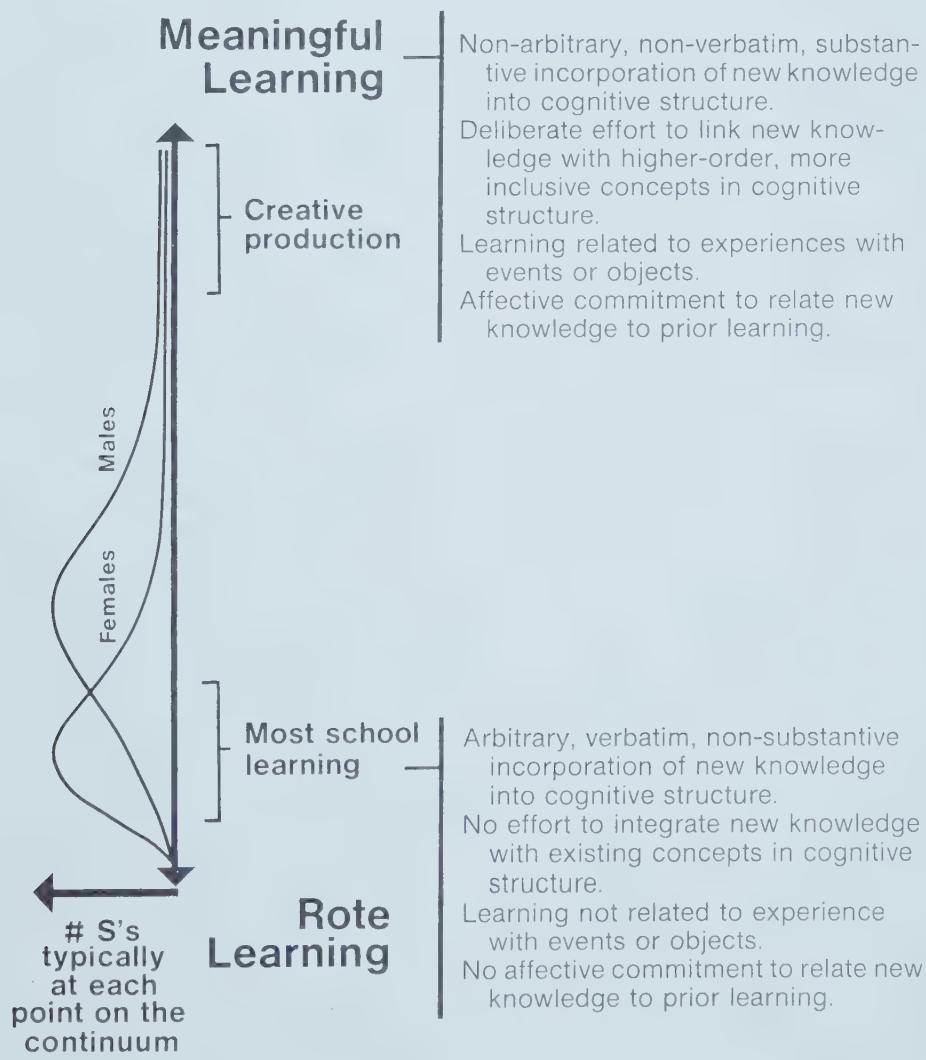


Figure 1. The Rote-meaningful learning continuum as represented in Ausubel's assimilation theory of cognitive learning. Hypothetical curves show differences between male and female populations in mode of learning (with differences exaggerated).

Most school learning procedures tend to stress and reward *verbatim* recall of knowledge of problem solutions. Socialization of females toward “doing what the teacher requires” is more accepted for females, whereas males are more often permitted (or even encouraged by their peers) to ignore or reject teacher expectations. One long-term result, we believe, is that females are more likely to adopt more rote-mode learning strategies than males (of course, with numerous exceptions) and hence to organize knowledge in cognitive structure in a less hierarchically integrated manner (see Novak, 1977, Chapter 8). Furthermore, socialization of children tends to favor relating new learning to real world experiences more for males than for females, the latter being less encouraged to “tinker” with science- or mathematics-related objects, thus adding to the arbitrariness of school learning for females. (See National Assessment of Educational Progress, 1979.)

We may reasonably assume that at lower levels of study in a discipline such as are found in high school, factors associated by Ausubel with rote-learning approach are more likely to predominate over factors which produce a meaningful learning approach. High school teachers may well be more likely than college instructors, for example, to reserve credit for answers which correspond in a verbatim fashion with whatever the learner has been taught (Novak, 1977). Students can perform satisfactorily in an essentially rote-learning mode when factors in the environment encourage rote-learning (Ausubel, 1977). However, at high levels of subject matter specialization, the failure to learn meaningfully is more likely to detract from assessed performance. Persistence in the discipline then depends on prior development of a disposition to learn meaningfully. This may account in part for some of the observed decline in senior mathematics classes by females.

Previous research done within an Ausubelian framework has supported the conclusion that prior concept learning in a specific subject matter area is the most important factor influencing learning (Ring & Novak, 1971; Tamir, 1968). Prior relevant concepts tend to organize and thus facilitate subsequent learning. Also small initial differences in prior relevant concepts can become enormous over years of schooling through the continuous effects of learning in either preparing or failing to prepare cognitive structures for new learning (Novak, 1977). Little evidence of these developing differences may appear when subject matter is presented with little attempt to relate concepts from topic to topic as is common in secondary school and some college courses. Typical instruction tends to compartmentalize learning into two- to four-week study units, with tests over this material requiring little more than recall of specific facts or application of stereotyped problem solving algorithms or rules. The integration of concepts into hierarchical frameworks of meaning spanning the whole course and/or linking with concepts in related courses or disciplines is rarely required at the secondary level. The consequence is that high achievement is possible or even favored with near rote-mode learning strategies with the resultant failure to produce more concept-integrative, meaningful learning strategies. The greater tendency of females to conform to expectations in such instructional practices will lead to progressively less capacity for building complex hierarchical meaning structures or less incentive to do so.

Sex-related differences could arise initially through such factors as greater exposure of males to science- and mathematics-related experiences prior to the first optional course in science or mathematics. Although initially small, any such difference in prior relevant experiences that embody key science or mathematics

concepts would have enormous effects later on through the "compound interest" effect of greater meaning conferred to prior relevant concepts (Novak, 1977). Our research at Cornell indicates that the most important concepts in terms of their later effects are those required at the beginning of a program of learning (Ring & Novak, 1971; Tamir, 1968). Therefore, sex-related differences in terms of meaningful learning of mathematics and/or science could develop over the grade school and high school years while having little effect on either enrolments or average levels of achievement at these levels. Such differences would nevertheless take their toll in terms of attitude toward the subject and willingness to persevere in it. Moreover, a nonmeaningful learning approach will be less successful in college level courses for the reasons given earlier.

The above theoretical account helps to explain why rates of enrolment and average levels of achievement do not necessarily differ markedly between the sexes during high school while enormous differences on related indices of participation (e.g., college enrolments) usually appear shortly thereafter. Lantz and Smith (1980) found that as long as mathematics is perceived to be useful, confidence in ability plays an important role in perseverance. Students of either sex can maintain sufficient confidence to stay with mathematics and science as long as formal learning opportunities require and stress only a relatively low level of understanding (i.e., limited integration of related concept meanings). Thus, enrolments probably indicate much less about long-term persistence than would a more accurate assessment of the tendency to acquire a broader level of understanding such as more advanced study requires.

Again, the above discussion should not be interpreted as minimizing the many other variables relevant to sex-related differences in career persistence; for example; differing sociocultural expectations other than those discussed above, same-sex role modeling, reinforcement for success in related endeavors, institutional barriers, etc. (Aiken, 1975; Fitzpatrick, 1976; Solmon, 1976). However, the compounding influence of previous learning that we wish to emphasize is as yet a largely unexplored aspect of career perseverance, and its absence in the current literature suggests that future research should incorporate an approach which makes the quality of learning and instruction itself more central.⁴

In view of this omission in the current literature, in particular studies directly testing the hypothesis advanced here, it is pertinent to consider briefly two ancillary studies bearing on the question of sex differences on variables related to meaningful learning. Although, again, they do not provide direct evidence for our hypothesis, they speak to the reasonableness of this type of approach as compared with exclusive reliance on the approaches more typically taken.

Two studies done at Cornell University dealt with factors influencing achievement in science and used sex as a variable. Atkin (1977) used an instructional strategy to encourage more meaningful learning of selected topics in organic chemistry. As with all of our studies, Atkin found that pretest scores for chemistry correlated significantly with course performance ($r=0.41$; $p<.01$; 59df), indicating the significance of relevant knowledge for subsequent learning in the subject area. Her evaluation of performance included more traditional questions requiring recall of specific information and also problem solving questions requiring application of concepts and principles in novel ways. Sex was not significantly correlated with posttest scores on factual recall items ($r=0.006$, $p>.05$; 59df) but was correlated with performance on posttest items dealing with novel problem

solving, with males performing better than females, particularly when instructions emphasized meaningful learning ($r=0.39$; $p<.05$; 29df).

Another study by Naegele (1974) was done in an introductory physics course utilizing a mastery learning approach (Bloom, 1968, 1976). Records were kept of the amount of study time required by students to pass each study unit at or above the criterion level. Learning efficiency values were computed for subjects, based on the average learning time required per study unit. The mastery learning approach permitted students to compensate for lack of prior knowledge; pretest knowledge in physics did not correlate with final performance ($r=-0.003$; $p>.05$; 699df). However, learning efficiency did correlate significantly with pretest score ($r=0.42$; $p<.01$; 55df) to the same extent as pretest knowledge and course performance in the Atkin study. Sex was also correlated significantly with learning efficiency ($r=0.42$; $p<.01$; 62df), indicating that males were more efficient in acquiring new knowledge. We believe this greater learning efficiency results from a greater tendency to use meaningful learning patterns that employ higher-order concepts and more deliberate integration of concepts and principles as indicated by interviews and indirect evidence in other research studies done by our group (see Novak, 1977, Chapter 8).

The differences indicated by these two studies, which account for some 18% of variance in performance, are several times the magnitude of sex-related differences in variance shown by science or mathematics course enrolment differences or differences in performance as measured by conventional achievement tests.

We believe that further research studies designed to assess the extent of high levels of meaningful learning will show sex differences favoring males and that longitudinal studies may indicate that this cognitive variable can account for much of the differential observed in male-female career choice and performance. Of course, many males may also be hampered by predominantly rote-learning patterns encouraged by school practices and thus we see eventual promise in new educational strategies for substantial improvement of education for both sexes. New strategies are being developed to encourage more meaningful educational practices (Novak & Gowin, 1982).

Notes

1. The authors gratefully acknowledge the advice and assistance given by Edward Kulick, Jason Millman and Miao-Hsiang Lin in the statistical analysis for this article.
2. Point-biserial correlations were used because the two variables, grade and age, are continuous and nominal variables, respectively.
3. A powerful test of the significance level for all four schools combined is possible using a method given in Darlington (1974) and other sources. However, this analysis would be superfluous given the highly significant results for each school separately.
4. Zuckerman (1977), a sociologist, has applied the notion of cumulative advantages to sex differences in science career achievements. However, her focus is almost exclusively on such facilitative factors as financial support, access to well-equipped laboratories, and close working relationships with established scientists. Again, the cumulative effects of meaningful learning experiences, or their lack, are not explicitly considered.

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References

- Aiken, L. R. Some speculations and findings concerning sex differences in mathematical abilities and aptitudes. In E. Fennema (Ed.), *Mathematics learning: What research says about sex differences*. The ERIC Science, Mathematics and Environmental Educational Clearinghouse. Center for Science and Mathematics Education, the Ohio State University, 1975.
- Anderson, R. C., Spiro, R. J., & Montague, W. E. *Schooling and the acquisition of knowledge* Hillsdale, N.J.: Lawrence Erlbaum Associates, 1977.
- Armstrong, J. M. Achievement and participation of women in mathematics: An overview. *Report of a two-year study funded by the National Institute of Education*, Report 10-MA-00. Education Commission of the States, March, 1980.
- Atkin, J. A. An information processing model of learning and problem solving. Unpublished Ph.D. thesis. Cornell University, 1977.
- Ausubel, D. P. *Educational psychology: A cognitive view*. New York: Holt, Rinehart and Winston, 1968.
- Ausubel, D. P. The facilitation of meaningful verbal learning in the classroom. *Educational Psychologist*, 1977, 12, 162-178.
- Ausubel, D. P., Novak, J. D., & Hanesian, H. *Educational psychology; A cognitive view*. New York: Holt, Rinehart and Winston, 1978.
- Bartlett, F. C. *Remembering*. Cambridge, England: Cambridge University Press, 1932.
- Benbow, C. P., & Stanley, J. C. Consequences in high school and college of sex differences in mathematical reasoning ability: A longitudinal perspective. *American Educational Research Journal*, 1982, 19, 598-622.
- Bloom, B. S. Learning for mastery. *UCLA Evaluation Comment*, 1968, 1(2), 1.
- Bloom, B. S. *Human characteristics and school learning*. New York: McGraw Hill, 1976.
- Bransford, J. D. *Human cognition*. Belmont, Cal.: Wadsworth, 1979.
- Darlington, R. C. *Radicals and squares and other statistical procedures for the behavioral sciences*. Ithaca, N.Y.: Logan Hill Press, 1974.
- Fennema, E. Influences of selected cognitive, affective, and educational variables on sex-related differences in mathematics learning and studying. In *Women and mathematics: Research perspectives for change* (National Institute of Education Papers in Education and Work: No. 8). Washington, D.C.: U.S. Government Printing Office, 1977.
- Fennema, E., & Sherman J. Sex-related differences in mathematics achievement, spatial visualization and affective factors. *American Educational Research Journal*, 1977, 14, 51-71.
- Fitzpatrick, B. *Women's inferior education: An economic analysis*. New York: Praeger, 1976.
- Gilmartin, K. J. Development of scientific careers: The high school years. Final report. National Science Foundation, Washington, D.C., 1976.
- Hyde, J. S. How large are cognitive gender differences? *American Psychologist*, 1981, 36(8), 892-901.
- Kintsch, W. *The representation of meaning in memory*. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1974.
- Konsin, M. A. Enrollment in Wisconsin high school mathematics classes by sex during 1975-76. Unpublished manuscript. University of Wisconsin-Madison, 1976.
- Lantz, A. P., & Smith, G. P. Determining the importance of factors influencing the election of mathematics courses. Final report. National Science Foundation Grant SED 78-171003, 1980.
- Naegle, C. J. An evaluation of student attitudes, achievement and learning efficiency in various modes of an individualized, self-paced learning program in introductory college physics. Unpublished Ph.D. thesis, 1974, Cornell University.

- National Assessment of Education Progress. Attitudes towards science: A summary of results from the 1976-77 national assessment of science. NIE, Report No. 08-5-02, 1979, Denver, Colorado.
- Novak, J. D. *A theory of education*. Ithaca, N.Y.: Cornell University Press, 1977.
- Novak, J. D., & Gowin, D. B. Concept mapping, vee mapping and clinical interviews for educating. Unpublished manuscript. Cornell University, 1982.
- Pedro, J. D., Wolleatt, P., Fennema, E., & Becker, A. D. Election of high school mathematics by females and males: Attributions and attitudes. *American Educational Research Journal*, 1981, 18, 207-218.
- Ridley, D. R., & Novak, J. D. Gender differences in career participation in science- and mathematics-related careers. Unpublished manuscript. Cornell University, 1980.
- Ring, D. G., & Novak, J. D. The effects of cognitive structure variables on achievement in college chemistry. *Journal of Research in Science Teaching*, 1971, 8, 325-333.
- Sells, L. The mathematics filter and the education of women and minorities. Paper presented at the meeting of the American Association for the Advancement of Science, Boston, Massachusetts, 1976.
- Solmon, L. C. *Male and female graduate students: The question of equal opportunity*. New York: Praeger, 1976.
- Tamir, P. Analysis of certain achievements and attitudes of Cornell students enrolled in introductory biology with special reference to their high school preparation. Unpublished Ph.D. Thesis, Cornell University, 1968.
- Vetter, B. M. Working women scientists and engineers. *Science*, 1979, 207, 23-34.
- Wise, L. The role of mathematics in women's career development. Paper presented at the annual meeting of the American Psychological Association, Toronto, Canada, August 1978.
- Zuckerman, H. *Scientific elite*. New York: Free Press, 1977.

PERSPECTIVES

The Performance-based/Developmental Debate About Student Teaching Supervision: A Typology and Tentative Resolution

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Supervisors of student teachers are typically confronted by two seemingly paradoxical concerns as they enter into the rigours and dynamic uncertainties of practicum supervision: one is a concern to aid student teachers in their personal and social development by reducing supervision-dependency needs through the mitigation of the threat factor inherent in the designation of the supervisor as the authority figure; the other is a here-and-now urgency to make the most productive use of the limited practicum time available through the cultivation of a business-like, task-oriented climate for supervision. These two concerns would also seem to characterize the major thrusts of student teaching supervision, the former towards an emphasis on the interpersonal helping relationship and the role of facilitator, the latter towards direct supervisory intervention as a form of task-oriented learning for student teachers. There appears then to be a tension between the claims of a performance-based direct approach to practicum supervision and the counter claims of a more inductive developmental process in which the supervisor's role is viewed as that of facilitator.

The thrust of this paper is to suggest that such a dichotomy is not only less than useful but likely fallacious. This suggestion rests on the premise that student teaching supervision may be regarded as a teaching process and, as such, represents a dynamic activity characterized by an urgent need to cope with and cater to the unexpected demands of an ambiguous and constantly changing environment. Such a context, it seems to us, precludes the luxury of adopting a bifurcated view of practicum supervision, i.e., direct versus indirect, in favour of a more

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interdependent view, namely one that calls for supervisor variability of approach and flexibility in interactive behaviours.

In the paper, there will therefore be an attempt to develop a typology of approaches available to supervisors caught up in the performance based/developmental debate. It will also contain a proposal for a balanced approach to supervision as a tentative resolution of the conflicting interpretations of the process. Such a typology and tentative resolution cannot, however, be described without first examining the context that surrounds student teaching practicum supervision.

The Performance-Based/Developmental Debate

Performance-based teacher education (PBTE) and its bed-fellow, competency-based teacher education (CBTE), have exerted considerable influence on student teaching supervision over the last fifteen years. Indeed, between August 1967 and January 1973 the American federal government spent over \$12 million on performance-based teacher education projects (Hamilton, 1973, p. 13), evidence of the recent trend towards conceptualizing the teaching process in terms of the competencies required in instructional performance to effect learning in students (Cooper & Weber, 1973). This trend essentially had its origins in the public disenchantment with teacher education programmes that found expression in Conant's (1963) analysis and Koerner's (1963) scathing criticism. Teacher complaints about the usefulness of their preparation for classroom practice (see Holt, 1964; Kohl, 1967) only exacerbated the situation.

Concomitant with this was the emerging demand that teachers be held accountable for student achievement. Teachers, in turn, rejoined that they were inadequately prepared for such a demand, since they lacked the skills and strategies necessary for ensuring that quality learning in students would inevitably take place as a result of instruction. Hence the performance-based teacher education movement was born so as to provide "training in which the prospective or inservice teacher acquires, to a prespecified degree, performance tendencies and capabilities that promote student achievement of educational objectives" (Gage & Winne, 1975, 146-147). The selection and definition of performance tendencies and capabilities is carried out in relation to the effects that such competencies are deemed to have on student achievement gains in terms of knowledge, skills and attitudes (Elam, 1971).

Performance-based teacher education (PBTE) draws its philosophical underpinnings from behavioural psychology and its application to training in industrial and military settings:

In such training, the repertoire of skills to be achieved was analyzed systematically to specify less complex behavioral components and their interrelationships. Training usually began with verbal instruction in the behavioral components, then proceeded with practice in performing the skills to be learned, and the practice was followed by corrective feedback. Additional cycles of instruction, practice and feedback would be provided as needed. The individual components were integrated so as to approximate more and more closely the complete repertoire. (Gage & Winne, 1975, 148-149)

This training strategy initially entered the field of education in the form of programmed instruction. During the 1960s, it was adapted to teacher preparation programmes in the form of micro-teaching (Allen & Ryan, 1969; Borg, 1972, Berliner, 1969). Teaching strategies were defined and categorized in terms of

discrete skills and preservice teachers were then expected to experiment with each of these skills in a shortened lesson period containing a reduced number of students. Many variations along this theme are found today in PBTE preparation programmes.

The PBTE approach contrasts considerably then with the conventional approach to teacher education—a combination of university courses in foundations and curriculum and instruction methods with a mandatory practicum where the supervisory function is shared by a sponsor teacher and a faculty advisor. The more conventional approach assumes that:

If the student teacher is exposed to what purports to be effective teaching, the osmosis process automatically will enable him to absorb from the supervising teacher an approach or style that is effective. At the same time, it is assumed that the process automatically filters out any approach or style that is not effective. (Oestreich, 1974, pp. 335-337)

Since, however, student teaching supervision and its effects on preservice teachers are largely unexamined by the participants, the assumptions of the conventional approach are controvertible in every case except where the supervisor (sponsor teacher and/or faculty advisor) is demonstrably an outstanding teacher. Indeed, Peck and Tucker (1973, p. 967) conclude that “at least by the end of student teaching, there are some almost universally reported decrements in attitude and teacher behavior, as compared with the starting position of students prior to their field experience.”

The case for PBTE is therefore a strong one, but one which is also subject to much criticism. Working alongside the university-based teacher education programme is the hidden yet powerful socialization process that bombards student teachers in the schools themselves. Getzels (1963, pp. 310-312) postulates one possible explanation of this covert “teacher education programme,” contending that schools are social organizations with institutional roles and expectations, i.e., the nomothetic dimension, that act as powerful socializing forces on preservice and beginning teachers. A study by Horowitz (1968), who found that schools could change student teacher attitudes in as little as two weeks, provides empirical support for this theoretical position. As a consequence, many critics (e.g. Rubin, 1979; Smith, 1975) question the claim that PBTE programmes can effect positive changes in teacher behaviour, skill and attitude, since the lack of a school-based component does not allow student teachers to acquire skills in the very arena where such socialization occurs.

Such criticism is, however, based on experiential and pragmatic grounds. A more serious criticism emanates from a difference in philosophical underpinnings. Human developmentalists (Bents & Howey, 1981; Birch, 1969b; Combs, 1972; Dewey, 1938; Glassberg & Oja, 1981; Glassberg & Sprinthall, 1980; Kohlberg & Mayer, 1972; Loevinger, 1976; Nemser, 1980; Piaget, 1970; Sprinthall & Mosher, 1978; Witherell, 1977; and Zumwalt, 1982) would suggest that PBTE can be deleterious in its effects on teachers and students alike. Combs (1972, pp. 286-290) outlines the critical features of a teacher education programme viewed from this perspective: (a) effective teacher education is highly personal and dependent on the prospective teacher’s development of an appropriate system of beliefs; (b) educating effective teachers is a process of promoting the “becoming” of a teacher, rather than one of educating a person in how to teach; (c) “becoming” an effective teacher has its origins in security and acceptance; (d) teacher education should emphasize meanings rather than behaviours; and (e) teacher education should focus more on the teacher’s subjective impressions and less on objectively gathered information

about the processes and effects of teaching. Developmentalists therefore argue that student teachers' classroom functioning is essentially determined by the complexity of their conceptual structure, i.e., the schema employed to make sense of the teaching experience. Conceptual complexity is seen, then, to act as an internal mediating cognitive process, varying according to the stage of each person's development, that governs the student teacher's classroom behaviour and actions. Teacher education is based on a developmental approach where the preparation programme provides for a balance between action and reflection as it attempts to foster human growth. Glassberg and Sprinthall (1980, p. 35) maintain that "student teaching presents a clear opportunity for learning by both doing and reflecting through classroom experience and a weekly supervision seminar."

The developmental approach is based on the ideas of Dewey (1938) and, to a lesser extent, Piaget (1970) and Kohlberg (1968) who claim that an emotionally engaging experience must be followed by reflective analysis if qualitative changes in growth and development are to occur. Developmentalists emphasize the role of the environment in creating disequilibrium, but caution that too much disequilibrium or dissonance can become overwhelming for the student teacher (Birch, 1969a), resulting in the arrestation of growth at the stage of development already attained and the cessation of progress towards higher levels of conceptual complexity. Teacher preparation programmes following this perspective generally emphasize role-taking, reflection, and support.

Glassberg and Sprinthall (1980), Glassberg and Oja (1981), and Bents and Howey (1981) all describe the major features of a developmental approach to teacher education. Essentially, developmental teacher education programmes involve participants in role-taking experiences, attempt to match the student teacher's developmental level with appropriate degrees of structure in the educational environment, allow for careful and continuous guided reflection, aim at establishing a balance between real experience and discussion/reflection, ensure programmatic continuity over a long period of time, and provide personal support and challenge for each of the programme participants.

Role-taking experiences, as distinct from role-playing (Mead, 1934), are activities grounded in everyday reality. They are, by definition, direct and active rather than vicarious and indirect. Student teachers are encouraged to tackle new, more complex interpersonal tasks than previously undertaken, the assumption being that the adoption of a different perspective, frequently that of another person, stimulates both cognitive and affective development. Glassberg and Sprinthall (1980) report on how they developed a curriculum containing a sequence of role-taking experiences designed specifically to teach student teachers to (1) observe and analyse their own teaching, and (2) supervise each other.

The "*matching*" of appropriate structure to the supervisee's developmental level is the essential theme of Glickman's (1981) approach to instructional supervision. Supervisees capable of functioning at higher levels of abstract thought often prefer less structured environments because they are then free to exercise initiative and responsibility, whereas less developmentally mature individuals frequently cannot cope with such situations and need highly structured environments.

Careful and continuous guided reflection of role-taking experiences in light of theoretical constructs and conceptual frameworks enables student teachers to examine their learning from a variety of perspectives. Such exploratory behaviour

generally leads to a deep internalization of theory in a manner that influences classroom practice.

Establishing a balance between real experience and discussion/reflection, together with *programmatic continuity* over a long period of time is seen as providing for student teacher progress to higher stages of development. Throughout the entire process, *the provision of personal support and challenge* for each of the programme participants is deemed to be essential. Challenge usually comes through the role-taking experiences and the structured environment which creates cognitive dissonance in student teachers. Such dissonance, however, can be devastating without necessary psychological support.

The developmental approach to teacher education is rooted in preparation programmes that combine action and reflection, doing and thoughtful analysis. The performance-based teacher education (PBTE) approach, on the other hand, emphasizes the training for and application of predetermined teaching behaviours and skills in a manner that systematically adds to and improves a student teacher's repertoire. Recent evidence of the reality of the performance-based/developmental debate is to be found in the October 1982 issue of *Educational Leadership*. Thematically entitled "The Coaching of Teaching," the issue highlights articles (Joyce & Showers; Berliner & Brandt; Mohlman, Kierstead, & Gundlach; Fonzi; and Evans) that lend credence to the PBTE premise that

All skills are broken down into discrete steps. We work on each segment, then combine them into whole skills . . . then go back and work on the specifics of skills that are giving problems The necessity of overlearning skills to the point of automaticity if they are to be useful in a more complex setting is reflected in . . . (a) training regimen. (Joyce & Showers, 1982, pp. 8, 10)

Indeed, *Educational Leadership's* Executive Editor, Ron Brandt, noting that David Berliner sees coaching as the only way to get substantial classroom change, states in the "Overview" that "coaching seems to be the most powerful way for some teachers to learn complex new practices" (Brandt, 1982, p. 3).

A close look at the other articles that address the issue of improving teaching and staff development (McCarthy; Wood, McQuarrie & Thompson; Thompson & Wood; Wilsey & Killion), however, indicates a strong leaning towards the developmental perspective where the authors are concerned to frame inservice teacher education around models that provide for differing stages of human growth. Indeed, the intensity of the critique and response dialogue between Fonzi and Thompson/Wood over "effective staff development practices" may be best understood in terms of a conflict of the performance-based perspective with a developmentalist approach. At no point do the contending authors appear to find common ground and, in the end, they remain entrenched in their respective positions:

We believe even more strongly in the potential of experiential learning to change and improve the quality of educational programs, but we welcome critics who would enter into dialogue about the efficacy of staff development and school improvement techniques. We would ask, however, that such dialogue or criticism suggest alternatives for improving staff development and not serve as a rationale for retreat from promising staff development practices, or continued use of outmoded and ineffective approaches to inservice education. (Thompson & Wood, 1982, p. 35)

The almost vitriolic sting contained in the last sentence of the above quotation is, for us, unfortunate. It does, however, demonstrate the need for a description of

the various approaches to supervision that fall under the respective rubrics of performance-based and developmental and for the articulation of a perspective that could provide a tentative resolution to the Fonzi-Thompson/Wood impasse.

A Typology of Approaches to Student Teaching Supervision

In attempting to analyze what constitutes effective teaching, the supervisor “must know which of his observations . . . on teaching have research support, which are drawn from experience or practice and which are assumptions, value judgments or prejudices about what and how children should be taught” (Mosher & Purpel, 1972, p. 35). Close examination of how each of these two broad approaches (the performance-based and developmental student teaching supervision) utilizes knowledge derived from research on teaching reveals a further classification: performance-based (direct) approaches can be categorized as ideological or technological while developmental (facilitative) approaches can be described as operating in an indulgent or deliberative mode. No approach is without its problems when exercised exclusively.

Performance-Based (Direct) Approaches

Student-teaching supervisors who are acutely aware of the time constraints in the school-based experience often, in the name of efficiency, gravitate toward a performance-based or direct style of supervision. Rather than see student teachers grapple with the problems encountered in teaching, such supervisors pragmatically provide instructions about what to do and when to do it. The assumption is that the student’s chances of success will thereby be enhanced and that the limited time available will be used more productively.

Figure 1 illustrates varying levels of utilization of “effective teaching” knowledge. The dimension of knowledge utilization provides, then, a point of discrimination between the ideological and technological modes of performance-based (direct) supervision. Direct supervision may be regarded as ideological when the supervisor strongly espouses and communicates positions on classroom teaching which are grounded more in personal values and experience than in knowledge derived from recent research. Where such positions emanate from research on teaching findings, however, direct supervision is deemed to have a technological orientation.

The ideological mode. Supervisors acting in the ideological mode tend to proceed directly and impose their strong views about teaching on student teachers. Although student teachers may be in a position to learn some very valuable teaching techniques, the supervisors’ shortcomings will become apparent when they are called upon to justify the procedures advocated, and can do so only on experiential grounds and/or value positions. The supervisors will be unable to enter into a meaningful discussion of alternate procedures and, therefore, little opportunity will be provided for the student teachers to practise making informed choices concerning procedures, materials and ways of responding to children. The supervisor’s personal teaching behaviour thus becomes a somewhat constraining model. Although potentially capable of generating a teaching style distinct from that of the supervisor, the student teacher is unlikely to do so while adhering closely to experientially-based directives issued by the supervisor.

The technological mode. Time-wary supervisors, who also command and utilize a sound knowledge of research on teaching, tend to adopt what Zumwalt (1982) has

termed a “technological orientation” in which teaching is regarded “as being composed of a definable repertoire of knowledge, skills and attitudes that a teacher brings to bear in an effort to create certain changes in learners” (Zumwalt, 1982, pp. 223, 224). Supervisors acting in this mode see their role as one of socializing preservice teachers to use on a regular basis the knowledge, skills and attitudes that research has demonstrated to be effective in leading to pupil learning gains. Accordingly, an approach so geared towards the modification of student teacher behaviour makes the specification of goals of central importance (Bandura, 1969). The behaviours, skills and attitudes which are still undeveloped in student teachers, though necessary to successful teaching, provide specific performance goals which serve as guidelines for supervisors and student teachers jointly engaged in a field experience. Once the behaviours or skills to be acquired have been identified, the students continue with practice sessions interspersed with evaluative feedback until those skills or behaviours are added to their repertoire and can be tested in a practical setting. Ultimately, this mode concentrates upon student teacher attainment of necessary classroom performance goals.

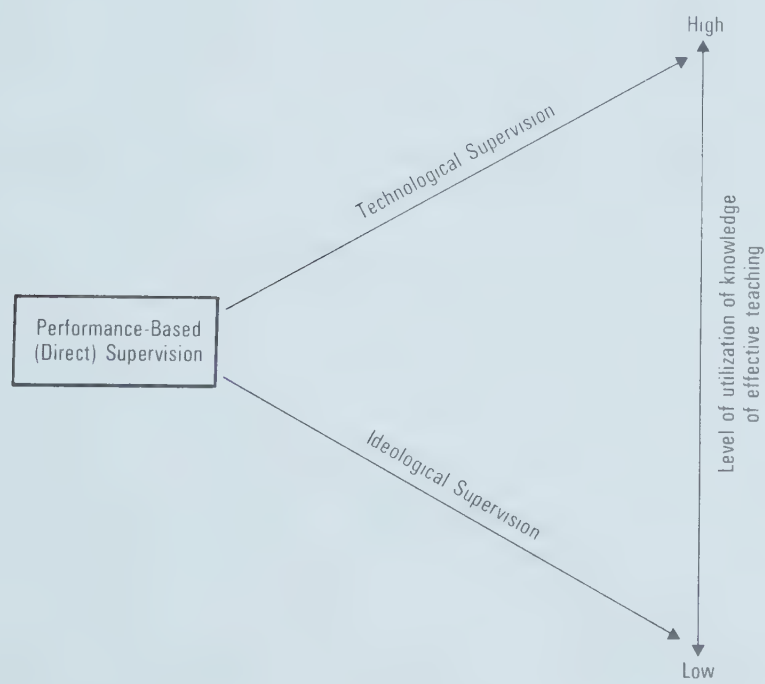


Figure 1: Performance-based (direct) supervision and knowledge utilization.

Developmental (Facilitative) Approaches

Whereas performance-based supervision has roots in the supervisor’s realization that time is short, developmental supervision may become the favored mode when a supervisor is trying to minimize the threatening aspects of the field experience for

the student teacher. The supervisor assumes a facilitative function, concentrating on the quality of relationship developed with the student and the creation of a supportive working environment in which professional growth may occur. Learning to teach is treated as a developmental process, one in which the student is encouraged to create his or her own unique style of teaching while working through the problems which emerge as the field-experience proceeds.

Joyce (1975, p. 134) elaborates on the process, noting that in preparing a teacher,

one must help him develop first, an adequate self; second, reliable ways of perceiving others and their goals, and third, the ability to learn substance when it is needed. To prepare such teachers, we must provide a helping relationship for the teacher candidate just as he must provide one for his students.

The absence of threat in the helping relationship provided for the student teacher is regarded as essential, for threat adversely affects perception in a way which would be detrimental to the learning taking place in a field-experience (Combs, 1971, p. 375). Threat narrows the perceptual field, producing tunnel vision, a condition in which a threatened person may fail to take into account the many variables that are present in a complex teaching-learning situation. Further, threat often gives rise to defensive behaviour with the result that an individual may cling to already held views, thus reducing the likelihood of perceptual change and associated new learnings.

Figure 2 demonstrates how the dimension of knowledge utilization allows for discrimination between two distinct modes of developmental (facilitative) supervision.

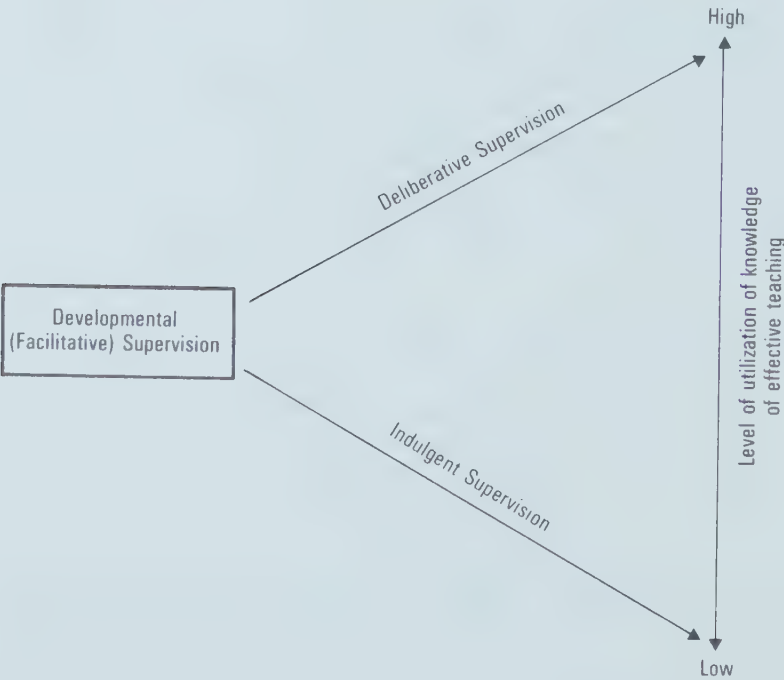


Figure 2: Developmental (facilitative) supervision and knowledge utilization.

The effort to provide a relatively nurturant and threat-free learning environment for student teachers varies according to the degree to which supervisors are able to utilize sound knowledge of effective teaching. Developmental (facilitative) supervision that is rarely grounded in substantive research knowledge can be described as indulgent while the utilization of such knowledge tends to foster a deliberative mode of operation.

The indulgent mode. In attempting to minimize threat, supervisors may entirely avoid stating expectations or making performance demands. If supervisors do not have an extensive understanding of what constitutes effective teaching, supervisory assistance may be limited to providing encouragement and the opportunity to learn by trial and error. Although they appreciate the empathic, sensitive, counselling aspects of a helping relationship, many student teachers nevertheless expect and request very practical help (Nias, 1977, p. 124) in matters such as understanding children, organizing learning experiences, locating materials and equipment, foreseeing trouble spots, and even mounting and displaying work. Indulgent supervision leaves such students floundering—unable to solve their problems and paired with supervisors who appear to be of little assistance. In such circumstances, one can foresee the possibility of deteriorating relationships.

The deliberative mode. Supervisors who command a body of knowledge concerning teaching effectiveness, are able to provide student teachers with the opportunity to discuss alternative strategies for achieving desired outcomes in pupils—outcomes contingent upon learner characteristics and the nature of the classroom environment. The mode of operation, characterized by Zumwalt (1982) as “deliberative,” regards teaching more as a clinical process of “aggregating and making sense out of an incredible diversity of information sources” (N.I.E., 1974, p. 3) that pertain to the demands of the classroom teaching-learning situation. The emphasis in this mode is on providing teachers with ways to think about and deliberate upon their classroom experiences in light of recent research on teaching. Zumwalt (1982, p. 237) posits that “the reality of teaching demands an approach to teacher education that accommodates the complexity of teaching, the similarities and uniqueness of individuals and contexts, the knowledge base and the judgmental aspects of the teaching process.” Student teachers who experience deliberative supervision are challenged to acquire a knowledge of research on teaching, to develop a critical orientation towards it, and to test it in practical situations. In doing so, they become better prepared to evaluate the curricular and methodological trends which are likely to emerge as their teaching careers unfold. Zumwalt (1982, p. 225) encapsulates the essence of this mode in her statement that “to improve education, . . . one educates teachers in a way that enhances their deliberations about teaching.” Without the capacity to be self-critical, a teacher can scarcely be considered professional.

Problems Associated with the Different Approaches

The exclusive application of any one approach to the supervision of student teaching may give rise to a variety of potential problems. The thrust of this paper is to suggest that more serious problems are likely to arise where supervisors largely ignore the growing body of knowledge pertaining to effective classroom teaching. That is not to say, however, that supervision in the technological or deliberative modes is without problem; rather, we see supervisor utilization of research findings as providing a more desirable and, to the student, acceptable base upon which both parties can tackle the inevitable problems that accompany practicum supervision.

Problems in the ideological mode. The issuing of directives about classroom teaching that are based largely on experience or value positions tends to elevate the supervisor, albeit somewhat inadvertently, to the position of sole teaching model. Just as the socialization of children is accomplished through their modeling or imitating the behaviour of significant others (Bandura & Waters, 1963), so the student teacher may elect to model the supervisor's teaching behaviour or elements thereof. A variety of rewards may be anticipated, not least of which would be the supervisor's approval and accompanying favorable evaluation, prerequisites to certification and employment. Alternately, students may imitate the supervisor's teaching behaviour in order to attain results similar to those achieved by the supervisor, particularly in the area of pupil understanding and cooperation; on the other hand, however, their modeling may represent a calculated attempt to "survive." The survival perspective has been identified as one which quickly replaces the initial, idealized friendly confidant's orientation, which characterizes most student teachers prior to their initial field experience (Fuller & Brown, 1975; Gibson, 1976). As the student teacher, on the basis of regular feedback, attempts to model the teaching behaviour of the supervisor more and more closely, the question of the adequacy of the model is one which becomes a central concern for teacher educators.

Problems in the indulgent mode. The use of developmental (facilitative) supervision without the "embracing arc of research on teaching . . . making the participants profoundly influenced by and unequivocally dependent upon the empirical knowledge derived from its enterprise" (Grimmett, 1981, pp. 29, 31), tends to reduce supervision to "a tea party" (Goldhammer, 1969, p. 61) where student teachers perceive the supervisor as not caring enough about classroom instruction to make suggestions and criticisms. In short, this non-directive, relatively passive approach, where "orthodox Rogerians are often misguided gamesters" (Goldhammer, 1969, p. 32), often results in a low level of productivity, interpersonal relations, and morale that characterizes an impoverished, rudderless approach to student teaching supervision.

Problems in the technological mode. The first and possibly most serious problem in this approach relates to the fact that a successful teaching performance is more than a package of achieved performance goals; that is, conceivably a student teacher might meet all of the specified performance objectives, yet fail to be able to combine them in a fashion exemplifying effective teaching. The selective reinforcement of effective components of teaching may be regarded as an approach which is too piecemeal to necessarily account for a unified teaching performance (McDonald, 1977, p. 30). Secondly, student teachers who have mastered certain performance objectives may find that the pupils or sponsor teacher or both in the classroom to which they are assigned are unaccustomed to and unreceptive towards the techniques. As Copeland (1979) relates, the "ecological system," the routines and customary teaching patterns of a particular classroom, is a significant variable in determining success for the student teacher. Thirdly, if student teachers are merely required to demonstrate skills chosen by others, they are deprived of the opportunity to create, discover and hypothesize, all of which are essential behaviours in a professional teacher (Zumwalt, 1982, p. 249). This may be the most serious limitation of the technological mode of performance-based (direct) supervision.

Problems in the deliberative mode. One of the major shortcomings of this approach lies in the fact that not everyone required to supervise student teachers

has the necessary degree of sensitivity and the required communication skills to function optimally in a supervisory mode in which student teachers are considered to be discovering their own personal teaching styles. Many supervisors are confronted with the dilemma of how to handle what they see as avoidable errors in classroom teaching, particularly sponsor teachers who inevitably must consider the effects of the student teacher's errors on the pupils. If pupils lose valuable learning time or feel threatened or confused through the student's experimentation, the sponsor teacher's responsibility to intervene on their behalf takes on greater significance. A second problem for the deliberative supervisor arises in the dual nature of the supervisory expectations that the student teachers hold. On one hand, they expect "detailed guidance on how to teach" (Nias, 1977, p. 125) and on the other, warm sensitive counseling. If their expectations of practical help are not met, students may be left floundering and soon lose confidence in their supervisors and in themselves. Such difficulties are likely to be exacerbated by a supervisory orientation towards indirect procedures. The limited background knowledge of teaching and learning, which characterizes many students, creates a third problem for the deliberative supervisor. Students may not be aware of many of the alternative courses of action available to them as they confront instructional problems. This then reinforces the Storey and Housego (1981) notion that the intervention of a second party assists teachers in identifying instructional needs and alternatives. Such a notion would suggest the need for periodic direction and focusing on the part of student teacher supervisors.

The dimension of knowledge utilization enables us to draw an important distinction: that the technological and deliberative modes are more informed and therefore more useful and acceptable to student teachers than the ideological and the indulgent. The problems associated with the preferred modes are accentuated, however, by any tendency to favour one to the exclusion of the other. Such a proclivity to the technological or the deliberative can only be reduced by a tentative resolution of the current debate.

A Tentative Resolution

Figure 3 provides a summary of the discussion thus far. Student teaching supervisors' choice of approach is determined by which of the two concerns (time and threat) is of greater importance and by the degree to which research-verified knowledge about classroom instruction is utilized in intervening with preservice teachers. In addition, Figure 3 also provides the base upon which a tentative resolution of the current performance-based/developmental debate can be proposed. The tendency of any debate is to produce polarity. It would seem to us, however, that there is a need for a perspective that allows for a balanced concern for both the time and threat factors and fosters a high propensity for the utilization of research-derived knowledge of teaching. Such a perspective would inevitably hold definite implications for teacher education programmes and research.

Consequences of Polarity

Figure 4 contains a demonstration of the consequences of polarity. Supervisors become entrenched in either the performance-based (direct) approach or the developmental (facilitative) approach. Where such an entrenched position makes little or no reference to research knowledge of effective teaching, the approach to student teaching supervision is likely to take on an impoverished character.

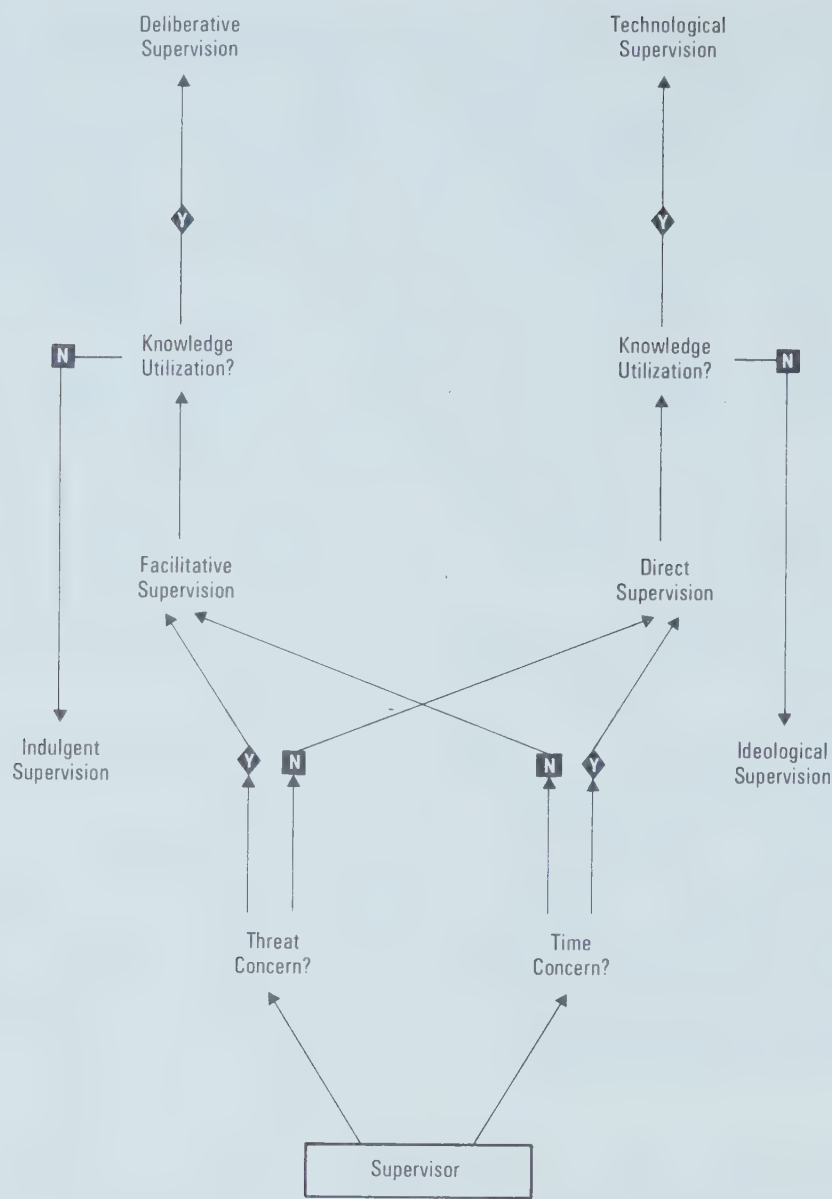


Figure 3: A typology of student-teaching supervision approaches.

An entrenched ideological or indulgent position. The possible dilemma posed by supervisors adopting an entrenched position, i.e., they tend towards either a direct approach or a facilitative one, is that they may address only one of the two major concerns that confront them in the reality of the practicum. Such restricted vision could be found to have deleterious effects on student teachers. The research of Thies-Sprinthall (1980) would suggest that where a less developmentally mature student is placed with a Rogerian-type supervisor, or where an independently minded student is paired with a directive supervisor, the potential for the practicum to become a miseducative process is high. Much has been written about the need for matching student teachers with similarly focused supervisors (see Brodbelt, 1980; Easterly, 1978; Kilgore, 1979; Lang, Cornish & Trew, 1980; McIntyre & Morris, 1980). An examination of the practicum time frame used in

many teacher education programmes, particularly that of “the distributed practicum,” would suggest, however, that matching *per se* is not the complete answer; rather, there appears to be need for supervisors to become less entrenched and to display greater flexibility in addressing both the concern for productive use of available time and the concern for the removal of threat and student dependency. Where such flexibility is not evident and research knowledge is not tapped, an entrenched position first becomes ideological or indulgent and ultimately impoverished.

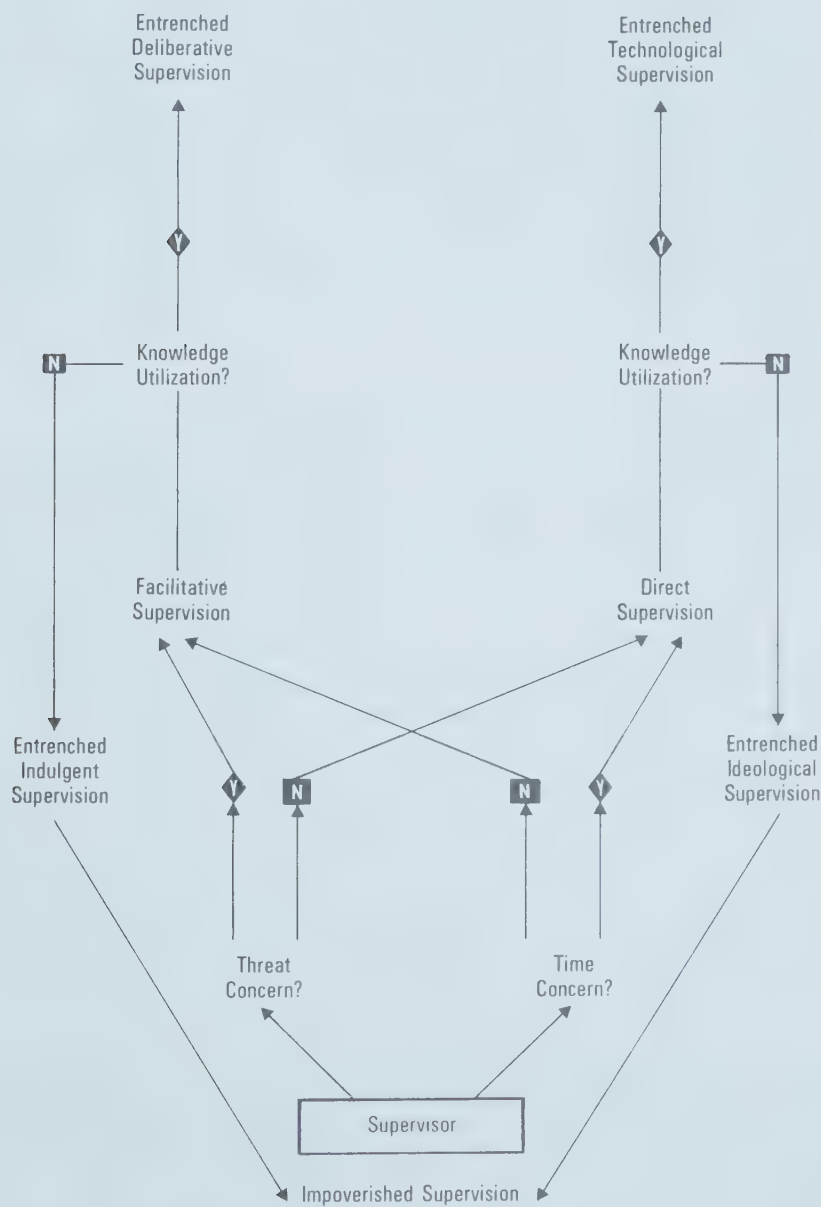


Figure 4: A typology of approaches and the outcomes of polarity.

An impoverished approach. This approach results in supervisors addressing neither the threat factor nor the concern for productive use of practicum time. Because their view of student teaching supervision is restricted to one side of the debate and to their own personal biases and values within that framework, supervisors fail to communicate an earnestness about the student teachers' classroom performance or their development as would-be professionals. As a consequence, supervisors are perceived as not caring about the student teachers, the pupils, the instruction, or the process of supervision in itself; rather their actions appear to be determined by self-interest and self-defence. Supervisory influence is therefore minimal.

Polarization between the performance-based (direct) and the developmental (facilitative) approaches inevitably leads to an entrenched position which, if research knowledge on teaching is not utilized, tends to degenerate, over time, into an impoverished approach. The use of substantive, technical knowledge by supervisors would seem to forestall the adoption of an impoverished approach by moving them away from the ideological and indulgent towards the technological and deliberative modes. But knowledge utilization in and of itself will not prevent polarity and entrenchment; what is required is an overarching perspective that provides for utilization of knowledge and the addressing of the dual concerns of time and threat.

A Suggested Answer: A Metadeliberative Perspective

The metadeliberative perspective provides a supraordinate conceptual framework that allows student teaching supervisors to take the dual concerns of time and threat into account. Figure 5 demonstrates how the technological and deliberative modes assume a metadeliberative perspective as supervisors become aware of the need to incorporate the other broad orientation and concern into their approach to practicum supervision. In other words, technological supervisors would seek to go beyond the mere imparting and practice of research-based knowledge and skills in a manner that trains prospective teachers for the classroom by providing them with opportunities to engage in role-taking, risk-taking activities that prompt guided reflection in light of the research findings that have been utilized. Similarly, deliberative supervisors would not merely be content with providing a research-embracing facilitative approach; rather, they would see the need to supplement student teacher reflective decision-making about classroom teaching with clear presentation, demonstration and opportunities for practice with feedback of specific instructional behaviours and skills. Research knowledge on teaching enables the supervisor then to engage the student in setting meaningful performance goals to which the preservice teacher can progress through sequenced practice and evaluation. The same research knowledge of teaching effectiveness may also enhance the working relationship between the student teacher and supervisor as they collaboratively attempt to recognize the complex, multifaceted nature of the task the student is aspiring to perform.

The metadeliberative perspective consequently encourages student teaching supervisors constantly to make choices at a meta level concerning the complex practicum mosaic composed of pupil learning needs, instructional performance needs, and supervisor-teacher relationship needs. At times, the emphasis may be more towards the needs of pupil learning and instructional performance, at others on the nurturing of confidence and professional autonomy in the preservice teacher.

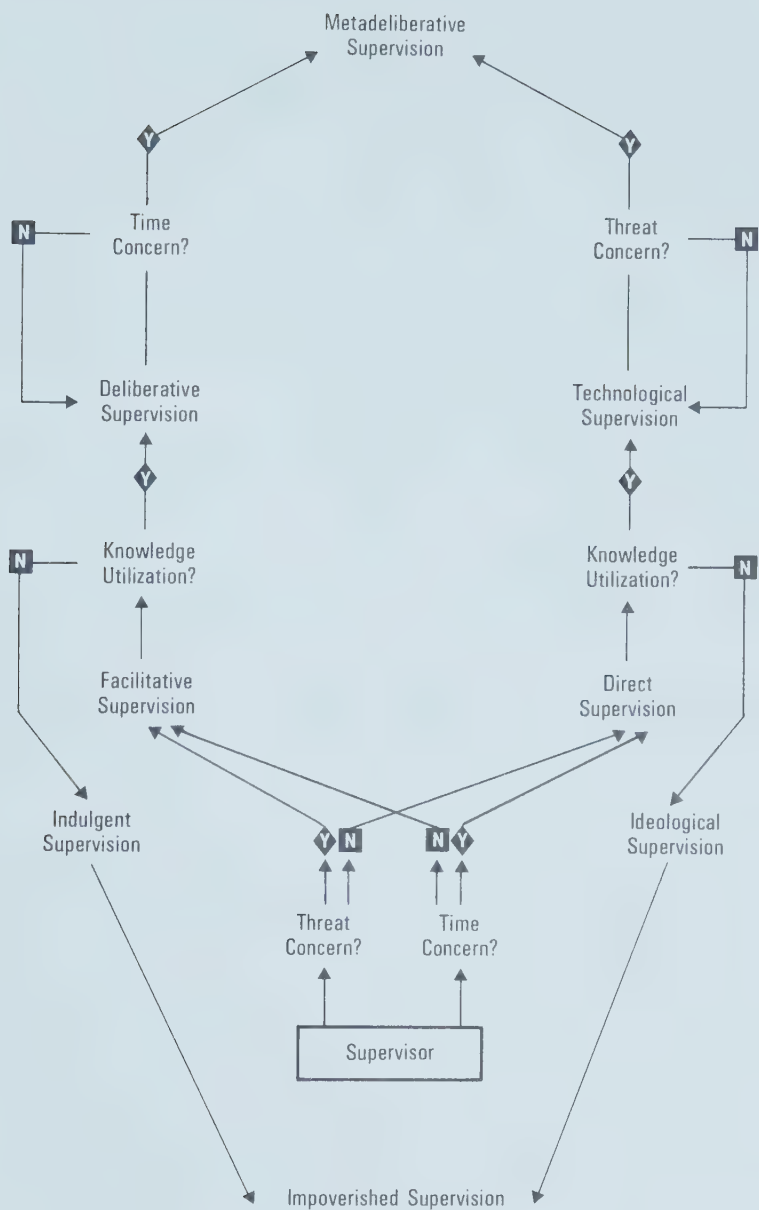


Figure 5: A typology of approaches and the metadeliberative perspective on supervision.

Throughout the process of practicum supervision, supervisors espousing the metadeliberative perspective constantly deliberate not on which research verified instructional skills to have preservice teachers practice (essentially the technological mode), nor on which research knowledge to share in order that student teacher understanding of classroom teaching be enlightened (essentially the deliberative mode), but rather on which of the two supervisory modes most appropriately meets the apparent and pressing needs of the specific practicum context and situation in which they must supervise at any given time. As such, the metadeliberative perspective fosters a continuous monitoring of the variables and needs that impinge on practicum supervision in order that the appropriate variability of approach associated with supervisor flexibility becomes possible. This tightrope-like

functioning on the part of student teaching supervisors would seem to us to epitomize the healthy tension that creatively energizes any learning experience. More significantly, it safeguards student teaching supervision from becoming entrenched in either the performance-based, technological orientation, or the developmental, deliberative approach. Such a perspective would appear then to hold certain implications for teacher education.

Implications of the Metadeliberative Perspective

The implementation of a metadeliberative perspective in student teaching supervision would hold specific implications for teacher and supervisor preparation programmes and for research on teacher education.

Teacher education preparation programmes. It would appear from the literature that teacher education programmes tend either towards a performance-based emphasis or a developmental approach. On the basis of the discussion pertaining to the metadeliberative perspective, there would appear to be a need to redirect the tendency of teacher and supervisor preparation programmes away from a restrictive focus on one conception or the other towards a more eclectic emphasis that draws on the strengths of both approaches. For teacher preparation programmes this would mean designing a curriculum that caters to the need for specific behaviours and skill acquisition and also provides for student teachers to stretch their thinking about what goes on in classrooms. For supervisor preparation programmes the curriculum would be designed to immerse would-be supervisors in recent research on teaching in a manner where they can learn to deliberate on practicum situations so as to utilize such knowledge along technological and/or deliberative lines according to the specific variables operative at the time.

Research on teacher education. The discussion of the metadeliberative perspective is an attempt to articulate a tentative, conceptual resolution to the performance-based/developmental debate. There is a need, however, to test the feasibility of such a perspective in the crucible of empirical practice. Specifically, there is a need to know more about the impinging factors of time and threat as they affect practicum supervision; we need to understand whether the controlled absence of one factor, e.g., an experimental study comparing student teaching supervision during a ten-month internship with a three-week practicum, would point to the fostering of one mode (in the case of our example, the deliberative) over the other or whether, as we would argue, there is always a need in student teaching supervision for a thoughtful blending of both the technological and the deliberative. Our position would be that it is difficult to imagine practicum situations in which the productive use of time and the mitigation of supervisor threat are not pervasive concerns. Consequently, we see the need for research studies to explore these aspects of practicum supervision with a view to verifying or confuting the need for a metadeliberative perspective.

References

- Allen, D., & Ryan, K. *Microteaching*. Reading, Mass.: Addison Wesley, 1969.
Bandura, A. *Principles of behavior modification*. New York: Holt, Rinehart & Winston, 1969.

- Bandura, A., & Waters, R. H. *Social learning and personality theory*. New York: Holt, Rinehart & Winston, 1963.
- Bents, R. H., & Howey, K. R. Staff development—change in the individual. In B. Dillon-Peterson (Ed.), *Staff development/organization development*. Alexandria, Va.: ASCD, 1981, 11-36.
- Berliner, D. C. *Microteaching and the technical skills approach to teacher training*. Technical Report No. 108. Stanford, Calif.: Stanford Center for Research and Development in Teaching, 1969.
- Berliner, D. C., & Brandt, R. On improving teacher effectiveness: A conversation with David Berliner. *Educational Leadership*, 1982, 40(1), 12-15.
- Birch, D. R. Effects of inquiry orientation and guided self analysis using videotape on the verbal teaching behaviour of intermediate grade student teachers. Unpublished doctoral dissertation, University of California at Berkeley, 1969. (a)
- Birch, D. R. Teacher education in British Columbia: The Simon Fraser University example. *Canadian Superintendents' Yearbook*, 1969. (b)
- Borg, W. R. The minicourse as a vehicle for changing teacher behaviour: A three-year follow-up. *Journal of Educational Psychology*, 1972, 63, 572-579.
- Brodbelt, S. Selecting the supervising teacher. *Contemporary Education*, 1980, 51(2), 86-88.
- Brandt, R. Overview. *Educational Leadership*, 1982, 40(1), 3.
- Combs, A. W. Intelligence from a perceptual point of view. In D. L. Avila, A. W. Combs, & W. W. Purkey (Eds.), *The helping relationship sourcebook*. Boston: Allyn & Bacon, 1971, 363-383.
- Combs, A. W. Some basic concepts for teacher education. *Journal of Teacher Education*, 1972, 22, 286-290.
- Conant, J. B. *The education of American teachers*. New York: McGraw-Hill, 1963.
- Cooper, J. M., & Weber, W. A. A competency-based systems approach to teacher education. In J. M. Cooper, W. A. Weber & C. Johnson (Eds.), *Competency-based teacher education: A systems approach to program design*. Berkeley, Calif.: McCutcheon, 1973, 7-18.
- Copeland, W. D. Student teachers and co-operating teachers: An ecological relationship. *Theory into Practice*, 1979, 18, 194-199.
- Dewey, J. *Democracy and education*. New York: MacMillan, 1938.
- Easterly, J. L. Mutual Choice placement—A humanistic approach. *Action in Teacher Education*, 1978, 1(1), 49-53.
- Elam, S. *Performance-based teacher education: What is the state of the art?* Washington, D.C.: American Association of Colleges for Teacher Education, 1971.
- Evans, P. R. Improving instruction through PET. *Educational Leadership*, 1982, 40(1), 44-45.
- Fonzi, M. A. A critique of "guidelines for better staff development." *Educational Leadership*, 1982, 40(1), 32-33.
- Fuller, F. F., & Brown, O. H. Becoming a teacher. In K. Ryan (Ed.), *Teacher education: The Seventy-fourth Yearbook of the National Society for the Study of Education*. Chicago: University of Chicago Press, 1975, 25-52.
- Gage, N. L., & Winne, P. H. Performance-based teacher education. In K. Ryan (Ed.), *Teacher education: The Seventy-fourth Yearbook of the National Society for the Study of Education*. Chicago: University of Chicago Press, 1975, 146-172.
- Getzels, J. W. Adults in the school and community. In W. W. Charters, Jr. & N. L. Gage (Eds.), *Readings in the social psychology of education*. Boston: Allyn & Bacon, 1963, 310-312.
- Gibson, D. R. The effect of school practice: The development of student perspectives. *British Journal of Teacher Education*, 1976, 2, 241-250.

- Glassberg, S., & Oja, S. N. A developmental model for enhancing teachers' personal and professional growth. *Journal of Research and Development in Education*, 1981, 14(2), 59-70.
- Glassberg, S., & Sprinthall, N. A. Student teaching: A developmental approach. *Journal of Teacher Education*, 1980, 21(2), 31-38.
- Glickman, C. D. *Developmental supervision: Alternative practices for helping teachers improve instruction*. Alexandria, Va.: ASCD, 1981.
- Goldhammer, R. *Clinical supervision: Special methods in the supervision of teachers*. New York: Holt, Rinehart & Winston, 1969.
- Grimmett, P. P. Clinical supervision and teacher thought processes. *Canadian Journal of Education*, 1981, 6(4), 23-39.
- Hamilton, P. D. *Competency-based teacher education*. Menlo Park, Calif.: Stanford Research Institute, 1973.
- Holt, J. *How children fail*. New York: Dell, 1964.
- Horowitz, M. Student-teaching experiences and attitudes of student teachers. *Journal of Teacher Education*, 1968, 19, 317-324.
- Joyce, B. Conceptions of man and their implications for teacher education. In K. Ryan (Ed.), *Teacher education: The Seventy-fourth Yearbook of the National Society for the Study of Education*. Chicago: University of Chicago Press, 1975, 111-145.
- Joyce, B. & Showers, B. The coaching of teaching. *Educational Leadership*, 1982, 40(1), 4-11.
- Kilgore, A. M. Pilot project shows definite link between pre and in-service education. *Journal of Teacher Education*, 1979, 30(4), 10-12.
- Koerner, J. D. *The miseducation of American teachers*. Baltimore: Penguin, 1963.
- Kohl, H. *36 children*. New York: New-American Library, 1967.
- Kohlberg, L. Stage and sequence: The cognitive-developmental approach to socialization. In D. A. Goslin (Ed.), *Handbook of socialization theory and research*. Chicago: Rand McNally, 1968.
- Kohlberg, L., & Mayer, R. Development as the aim of education. *Harvard Educational Review*, Nov. 1972, 42, 449-496.
- Lang, H., Cornish, W., & Trew, L. Partners in training. *Education Canada*, 1980, 20(3), 14-21.
- Loevinger, J. *Ego development*. San Francisco: Jossey-Bass, 1976.
- McCarthy, B. Improving staff development through CBAM and AMAT. *Educational Leadership*, 1982, 40(1), 20-27.
- McDonald, F. J. Research and development strategies for improving teacher education. *Journal of Teacher Education*, 1977, 28(6), 29-33.
- McIntyre, J. D., & Morris, W. R. Research on the student teaching triad. *Contemporary Education*, 1980, 51(4), 193-196.
- Mead, G. H. In C. W. Morris (Ed.), *Mind, self, and society from the standpoint of a social behaviorist*. Chicago: University of Chicago Press, 1934.
- Mohlman, G. G., Kierstead, J., & Gundlach, M. A research-based inservice model for secondary teachers. *Educational Leadership*, 1982, 40(1), 16-19.
- Mosher, R., & Purpel, D. *Supervision: The reluctant profession*. Boston: Houghton Mifflin, 1972.
- National Institute of Education. *Teaching as clinical information processing, Panel 6 summary*. Washington, D.C.: N.I.E., 1974.
- Nemser, S. F. Growth and reflection as aims in teacher education: Directions for research. In G. E. Hall, et al. (Eds.), *Exploring issues in teacher education: Questions for future research*. Austin: Research and Development Center for Teacher Education, University of Texas at Austin, 1980.

- Nias, J. What should Nellie do? Students' role expectations for head and class teachers on supervised practice. *British Journal of Teacher Education*, 1977, 3, 121-130.
- Oestreich, A. H. The professional growth of the student teacher. *Phi Delta Kappan*, 1974, 55, 335-337.
- Peck, R. F., & Tucker, J. A. Research on teacher education. In R. W. Travers (Ed.), *Second handbook of research on teaching*. Chicago: Rand-McNally, 1973.
- Piaget, J. *Science of education and the psychology of the child*. New York: Viking, 1970.
- Rubin, L. Panel reactor to Bruce R. Joyce's paper: "In-service, new perspectives on an old term" at a Vancouver Symposium on In-Service Education, hosted by Simon Fraser University, May 16, 1979.
- Smith, B. O. "Untimely notes on the preparation of educational personnel" cited by Bush, R. N., & Enemark, P., Control and responsibility in teacher education. In K. Ryan (Ed.), *Teacher education*. Chicago: University of Chicago Press, 1975, 292.
- Sprinthall, N. A., & Mosher, R. L. *Value development as the aim of education*. New York: Character Research Press, 1978.
- Storey, V. J., & Housego, I. E. Personnel supervision: A descriptive framework. *Canadian Administrator*, 1980, 19(6).
- Thies-Sprinthall, L. Supervision: An educative or mis-educative process. *Journal of Teacher Education*, 1980, 21(4), 17-20.
- Thompson, S. R., & Wood, F. H. Staff development guidelines reaffirmed: A response to Fonzi. *Educational Leadership*, 1982, 40(1), 34-35.
- Wood, F. H., McQuarrie, F. O., & Thompson, S. R. Practitioners and professors agree on effective staff development practices. *Educational Leadership*, 1982, 40(1), 28-31.
- Wilsey, C., & Killion, J. Making staff development programs work. *Educational Leadership*, 1982, 40(1), 36-43.
- Witherell, C. Theories of adult development: Implications for the education of teachers. In K. Howey (Ed.), *Alternative perspectives on adult growth and development: Implications for teacher education*. Minneapolis: Teacher Corps, 1977.
- Zumwalt, K. K. Research on teaching: Policy implications for teacher education. In A. Lieberman & M. W. McLaughlin (Eds.), *Policy making in education*. Chicago: NSSE, 1982, 215-248.

BOOK REVIEWS

UNTERSUCHUNGEN ZUM MATHEMATIKUNTERRICHT (STUDIES IN MATHEMATICAL EDUCATION) SERIES. *Edited by the Institute for the Didactics of Mathematics, University of Bielefeld, West Germany.* Vol. 1: FRAGEN DES GEOMETRIEUNTERRICHTS; Vol. 2: PERSPEKTIVEN FÜR DIE AUSBILDUNG DES MATHEMATIKLEHRERS; Vol. 3: FORSCHUNG IN DER MATHEMATIKDIDAKTIK. Cologne, West Germany: Aulis Verlag Deubner & Co., 1981, 236, 308, and 276 pp.

The purpose of this new publication series as described in each of its first three volumes is to inform about the work of the Institute for the Didactics of Mathematics (IDM), a supraregional central institute for research, development, and co-ordination in mathematical education established at the University of Bielefeld, West Germany. The work of IDM is characterized by the importance attached to the interaction between theory and practice. The teacher is indeed undervalued when research is supposed not to be interesting or meaningful to him; research is likewise undervalued when it is held to be powerless and without implications for practice.

The most important work of IDM is published in the series "Untersuchungen zum Mathematikunterricht" (Studies in Mathematical Education). Two other series, respectively entitled "Schriftenreihe" (Monograph Series) and "Materialien und Studien" (Materials and Studies), are more in the nature of reports on the research done at IDM. In addition, there is a series entitled "Occasional Papers."

The first volume in the series under review is edited by H. G. Steiner and B. Winkelmann and entitled *Fragen des Geometrieunterrichts* (Problems of Geometry Teaching). It contains several papers originally presented to a conference on geometry organized by IDM and ICMI in 1974 as well as several papers delivered at a conference on curriculum change during the past twenty years and which was convened by IDM and IEA in 1980. Papers included in the volume are as follows: "Geometrie im Mathematikunterricht: Eine Analyse neuerer Entwicklungen" (Geometry in Mathematical Education: An Analysis of Recent Developments) (H. J. Vollrath); "Zur Veränderung geometrischer Begriffssysteme durch die Reform der Lehrmittel" (Towards a Change in Geometrical Conceptual Systems by means of a Reform of Instructional Media) (P. Damerov); "Ein umfassender und moderner Geometrieunterricht" (Comprehensive and Modern Geometry Teaching) (W. Servais); "Geometrie in der Grundschule" (Geometry in the Primary School) (H. Freudenthal); "Neuer Geometrie-Unterricht auf der Sekundarstufe" (New Geometry Teaching at the Secondary School Level) (G. Schoemaker, A. Goodijn, J. de Lange, and M. Kindt); "Die Inzidenzgeometrie im Dienste einer progressiven und polykonkreten Pädagogik" (Incidental Geometry

at the Service of a Progressive and Polyconcrete Pedagogics) (G. Glaeser); “Visuelle Mathematik” (Visual Mathematics) (A. J. Bishop); “Geometrisches Verständnis und die Lösung von Problemen” (Geometrical Understanding and the Solving of Problems) (T. J. Fletcher); “Die Bedeutung der Darstellenden Geometrie für die Mathematikausbildung” (The Significance of Representational Geometry for Mathematical Education) (G. Pickert); “Aktuelle Probleme des Geometrieunterrichts aus der Sicht der Bielefelder Geometrietagung” (Present-Day Problems in Geometry Teaching as seen from the Perspective of the Bielefeld Conference on Geometry) (H. G. Steiner and B. Winkelmann).

In these papers the emphasis is on the pedagogical and psychological aspects of the problems considered, rather than on mathematical content. The research trends promoted by Thom (ICMI Conference, Exeter, 1972) and by Freudenthal may be seen to be reflected in them. Also, new developments in mathematics, as well as practical applications and problem-oriented geometry, come in for treatment. The interest here is more in the process of building up geometric concepts and in the practical value of the latter than in a formal, structural approach to geometry. Connections with space also come to the fore.

The second volume in the series is edited by the IDM working group on the Education of Mathematics Teachers—consisting of fourteen members—and entitled *Perspektiven für die Ausbildung des Mathematiklehrers* (Perspectives on the Education of Mathematics Teachers). It is based on the work of a conference devoted to “Trends and Problems in the Education of Mathematics Teachers” and organized by IDM in 1975.

The first chapter, “Probleme der Unterrichtsreform” (Problems relating to Educational Reform), deals with research on educational innovation, with special reference to the reform of mathematics as a school subject in the Federal Republic of Germany. Innovation processes are studied here as teacher education is, rightly, regarded as a means of innovation.

The second chapter, which is given over to “Neue Formen und Modelle der Lehrerbildung” (New Forms and Models of Teacher Education), discusses teacher effectiveness, the problem of the relation between theoretical knowledge and practical experience, and methods used in teacher education, such as group-dynamic experiences, observation, microteaching, protocol materials, training in teacher models, competency-based teacher education, and inservice training.

The third chapter probes more deeply into the problem of the relation between theory and practice.

The fourth chapter, devoted to “Mathematiklehrerbildung und die Natur des Wissens” (The Education of Mathematics Teachers and the Nature of Knowledge), is the most substantial part of the book, dealing as it does with the influence of mathematics as a science on mathematics as a school subject, the structure of the latter discipline, the relation between concept formation and mathematical proof, and, finally, knowledge and metaknowledge.

The volume concludes with a summary and a comprehensive bibliography.

The third volume in the series, edited by H. Bauersfeld, H. W. Heymann, and J. H. Lorenz, and which is concerned with *Forschung in der Mathematikdidaktik* (Research on the Didactics of Mathematics), derives from a conference organized by IDM in 1977 and which had as its theme “Methods of Research on Teaching in the field of the Didactics of Mathematics: Working Examples, Present-Day Problems, and Future Strategies.” The book, which consists of seventeen papers by

as many different authors, is articulated around five topics: teacher-pupil interaction; pupil-oriented research; the teacher and research in education; and methodology and content in research on the didactics of mathematics.

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EVALUATING THE QUALITY OF LEARNING. THE SOLO TAXONOMY (STRUCTURE OF THE OBSERVED LEARNING OUTCOME). *By J.B. Biggs and K.F. Collis.* London: Academic Press Inc., 1982, 245 pp.

The authors of this volume emphasize the importance of being able to identify quality in learning and in essence the book outlines their search for this rather elusive entity. Their major objective was to develop "a criterion referenced measure of the quality of learning" (p. 8). In order to accomplish this task they proceeded to analyze the organization of responses to academic questions by numerous students from all levels of the educational spectrum. They conclude that the basis of quality learning can be found in structural organization which allows one to discriminate well learned material from poorly learned material in a manner parallel to the way one distinguishes immature thought from mature thought. This structural organization which they label SOLO (Structure of Observed Learning Outcomes) forms the basis for a taxonomy which the authors believe can be used to evaluate the quality of learning in varying subjects and at varying educational levels.

The book is divided into four parts. Part I describes the general structure of the Taxonomy. Part II deals with the application of the Taxonomy to various subject areas (including reading, poetry and creative writing). Part III discusses the implications of the Taxonomy for educational practice. Part IV speculates on the ramifications of the taxonomy in educational and psychological theory. Parts I through III are designed for the practitioner; Part IV is designed for the theoretician.

Parts I and IV were of particular interest to this reviewer. In Part I the authors discuss the nature of instruction and the subsequent evaluation of learning. Three models of evaluation are reviewed: those of Bloom, Engelhart, Furst, Hill and Krathwohl (1956), Schroder, Driver and Struefert (1967), and Marton and Saljo (1976). The merits of each framework are highlighted, and particular attention is paid to their attempts to identify increasing levels of structural complexity. The authors observe that their orientation tends to vary from the others in that they believe that there are "natural stages in the growth of learning any complex material or skill and that in certain respects these stages are similar to, but not identical with, the developmental stages in thinking described by Piaget and his co-workers" (p. 15).

The basic structure of the SOLO taxonomy is delineated in chapter two. The authors describe the interrelationship between learning and development and develop their rationale for a relationship between developmental stages and learning quality. In brief, a person's developmental stage might determine the upper limit of functioning, but other factors such as motivation, etc. might result in

one not performing to that particular level. The need to distinguish between learning and development meant that the authors had to develop different terminology to distinguish levels of learning quality from cognitive levels (Piagetian Stages). Therefore the SOLO levels of “prestructural, unistructural, multistructural, relational and extended abstract are isomorphic to, but logically distinct from the stages of preoperational, early concrete, middle concrete, concrete generalization and formal operational, respectively” (p. 31).

Two major concerns are addressed in Part IV—those of a methodological nature (issues of reliability and validity) and those of a theoretical nature, that is the relationship of SOLO to other models of learning and development.

Generally the authors conclude that they are encouraged by the analysis they have conducted regarding reliability and validity of the SOLO taxonomy, and state that “several studies, involving the rating of history items, poetry and creative writing” have given rise to correlations between independent raters ranging from .71 to .95. In regards to validity, they note that several approaches have been utilized, including agreement with teacher ratings of quality, factor analytic studies and process analysis, and in general they are satisfied with the results of their preliminary work in this area.

The final chapter concentrates on the issues and implications that SOLO raises for psychological theory in general and for Piagetian theory in particular.

The strength of this work lies in its general applicability to the field of education. The authors have bridged the gap between theory and practice and have produced a valuable piece of work of use to both teachers in the field and to academics. Educators can readily adapt the taxonomy to fit their particular content area and academics have “food for thought” in terms of the relationships posited between psychological development and learning outcomes.

In sum this book proved to be an interesting, practical, and thought-provoking piece of work which lived up to the authors’ promise to be of value to both practitioner and theoretician.

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References

- Bloom, B.S., Engelhart, M.D., Furst, E.S., Hill, W.H., & Krathwohl, D. *Taxonomy of educational objectives: The cognitive domain*. New York: McKay, 1956.
- Marton, K., & Saljo, R. On qualitative differences in learning: I - outcome and process. *British Journal of Educational Psychology*, 1976, 46, 4-11.
- Schroder, H.M., Driver, M.J., & Struefert, S. *Human information processing*. New York: Holt, Rinehart & Winston, 1967.

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1. All manuscripts must be typewritten, double spaced, and submitted in duplicate. An abstract of approximately 100 words in length, typed on a separate page, should be provided.
2. Tables must be numbered in Arabic numerals with the word 'Table' centered and in capital letters, e.g., TABLE 4. The heading of the table is to be centered below and typed in capitals. The format of tables should conform to the specifications in the APA Publications Manual.
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